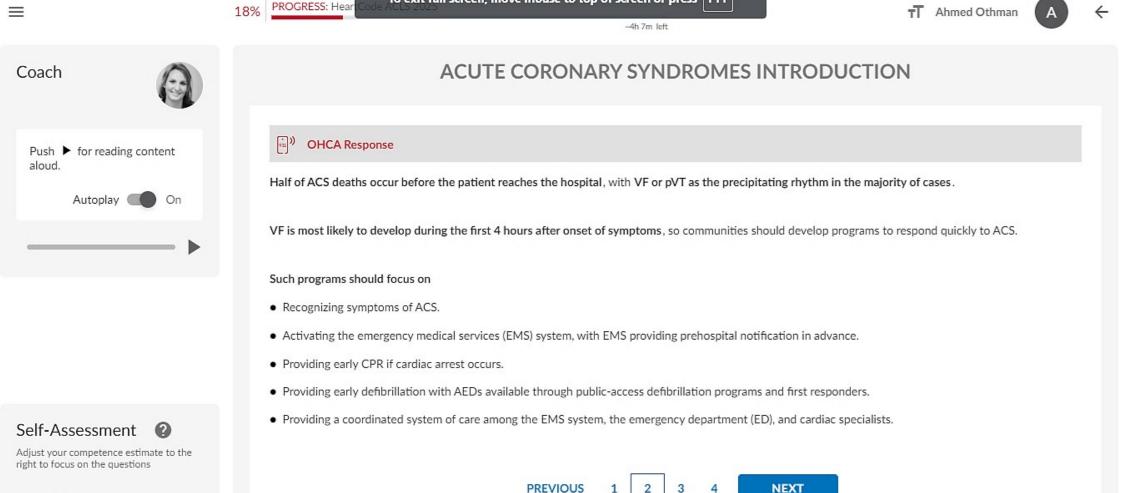


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# **ACUTE CORONARY SYNDROMES INTRODUCTION**

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# STEMI Chain of Survival

The STEMI Chain of Survival is similar to the Chain of Survival for sudden cardiac arrest. Its links indicate the actions that patients, family members, and healthcare providers can rapidly take to maximize STEMI recovery:

- · Recognition and reaction to STEMI warning signs.
- · EMS dispatch and rapid EMS system transport and prearrival notification to the receiving hospital.
- · Assessment and diagnosis in the ED (or cath lab).
- Treatment.



**PREVIOUS** 

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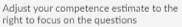
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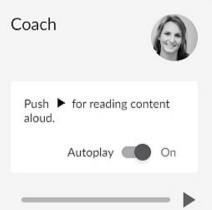
# Self-Assessment





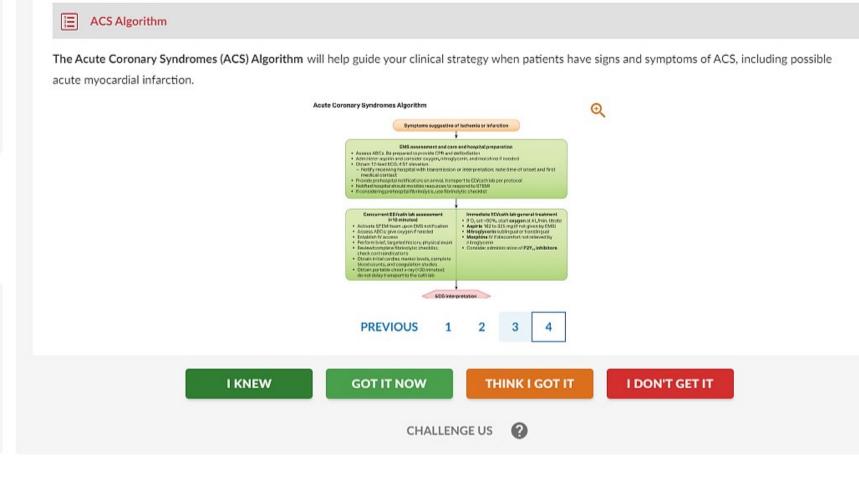






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# SIGNS AND SYMPTOMS OF ACS

The most common symptom of myocardial ischemia and infarction is retrosternal chest discomfort. The patient may perceive this discomfort more as pressure or tightness than as actual pain.

Chest discomfort is the major symptom in most patients (both men and women) with ACS, but patients frequently deny or misinterpret this and other symptoms. The elderly, women, diabetic patients, and hypertensive patients are most likely to delay, in part because they are more likely to have atypical symptoms or presentations.

Keep in mind that older adults and women may present without chest pain.

## Symptoms that suggest ACS may also include

- Uncomfortable pressure, fullness, squeezing, or pain in the center of the chest lasting several minutes (usually more than a few minutes)
- Chest discomfort spreading to the shoulders, neck, one or both arms, or jaw
- · Chest discomfort spreading into the back or between the shoulder blades
- Light-headedness dizziness fainting syncope sweating payers or vomiting

**I KNEW** 

**GOT IT NOW** 

THINK I GOT IT

I DON'T GET IT

**CHALLENGE US** 



# Self-Assessment









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# Symptoms that suggest ACS may also include

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Keep in mind that older adults and women may present without chest pain.

- · Chest discomfort spreading into the back or between the shoulder blades
- · Light-headedness, dizziness, fainting, syncope, sweating, nausea, or vomiting
- · Unexplained sudden shortness of breath, which may occur with or without chest discomfort
- . Less commonly, the discomfort occurs in the epigastrium and is described as indigestion

Self-Assessment



Adjust your competence estimate to the right to focus on the questions



These symptoms may also suggest other life-threatening conditions, including aortic dissection, acute pulmonary embolism, acute pericardial effusion with tamponade, and tension pneumothorax.

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SIGNS AND SYMPTOMS OF ACS

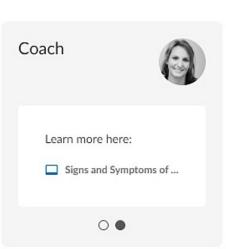
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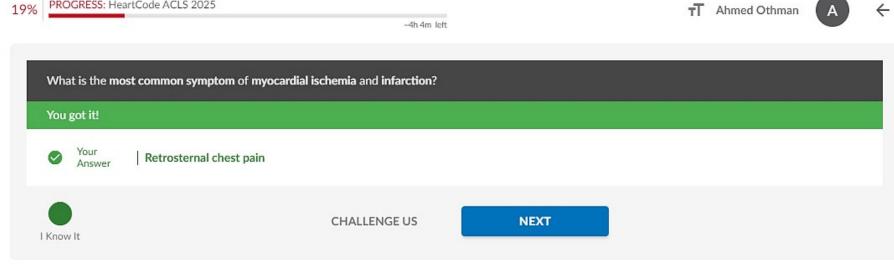
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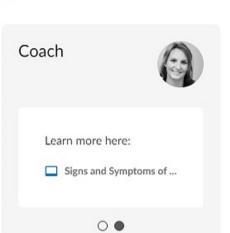
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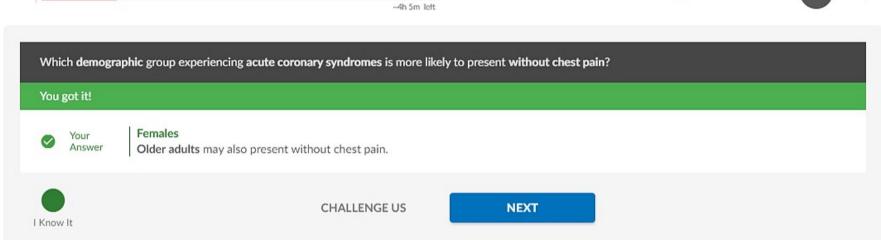






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# EMS ASSESSMENT, CARE, AND HOSPITAL PREPARATION

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Step 2 in the algorithm outlines EMS assessment, care, and hospital preparation. EMS responders may perform the following assessments and actions as they stabilize, triage, and transport the patient to an appropriate facility.

- · Assess ABC (airway, breathing, circulation). Be prepared to provide CPR and defibrillation.
- Administer aspirin and consider oxygen, nitroglycerin, and morphine if needed.
- Obtain a 12-lead ECG. If there is ST elevation, notify the receiving hospital with a transmission or interpertation; note the time of onset and first medical
  contact.
- Provide prehospital notification; on arrival, transport to ED/cath lab per protocol.
- The notified hospital should mobilize resources to respond to STEMI.
- If considering prehospital fibrinolysis, use a fibrinolytic checklist.
- If out-of-hospital providers cannot complete these initial steps before the patient arrives at the hospital, the ED provider should do so.

















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# EMS ASSESSMENT, CARE, AND HOSPITAL PREPARATION

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- If considering prehospital fibrinolysis, use a fibrinolytic checklist.
- If out-of-hospital providers cannot complete these initial steps before the patient arrives at the hospital, the ED provider should do so.



# Obtaining a 12-Lead ECG

The American Heart Association (AHA) recommends out-of-hospital 12-lead ECG diagnostic programs in all EMS systems, and all EMS systems should take the actions outlined in the table.

EMS actions per AHA recommendations:

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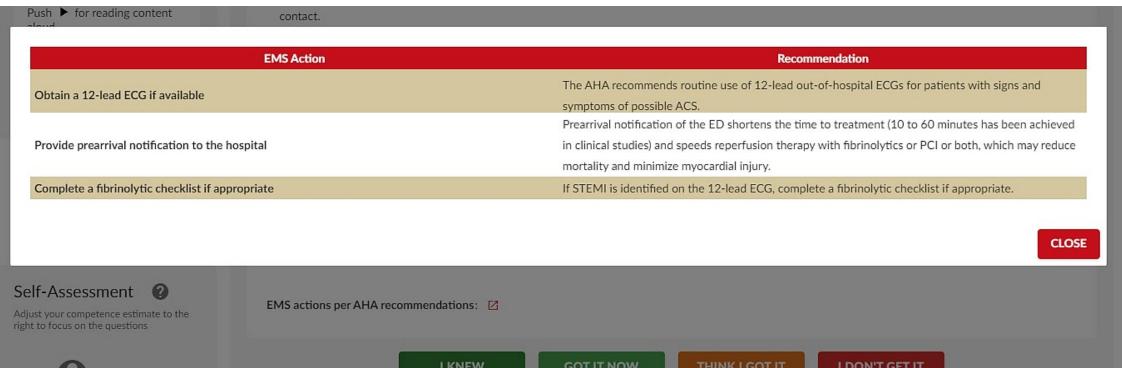
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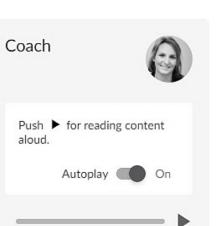
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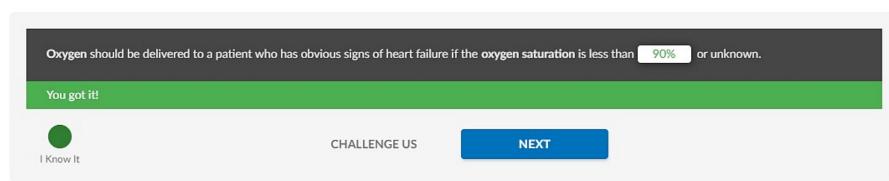






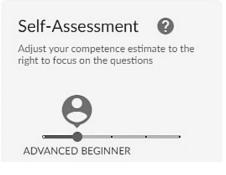
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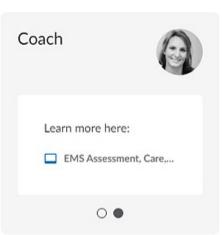
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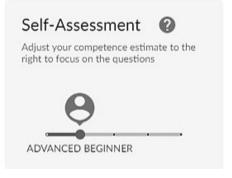
















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**Initial Actions** 

- · Activate STEMI team upon EMS notification.
- Assess ABCs; give oxygen if needed.
- Check vital signs and evaluate oxygen saturation.
- Establish intravenous (IV) access.
- Perform a brief, targeted history and a physical exam.
- Review and complete the fibrinolytic checklist; check contraindications.

ECG (if not already performed before arrival) and assess the patient.

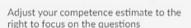
- Obtain initial cardiac marker levels, complete blood counts, and coagulation studies.
- Obtain a portable chest x-ray (in less than 30 minutes), do not delay transport to the cath lab.

**NEXT** 

**CHALLENGE US** 



# Self-Assessment

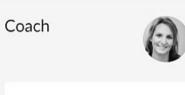




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CONCURRENT ED OR CATH LAB ASSESSMENT

The ED high-performance team should quickly evaluate the patient with potential ACS on the patient's arrival. Within the first 10 minutes, obtain a 12-lead



CONCURRENT ED OR CATH LAB ASSESSMENT







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# **Initial Actions**

- · Activate STEMI team upon EMS notification.
- · Assess ABCs; give oxygen if needed.
- Check vital signs and evaluate oxygen saturation.
- Establish intravenous (IV) access.
- · Perform a brief, targeted history and a physical exam.
- · Review and complete the fibrinolytic checklist; check contraindications.
- Obtain initial cardiac marker levels, complete blood counts, and coagulation studies.
- Obtain a portable chest x-ray (in less than 30 minutes), do not delay transport to the cath lab.

The results of cardiac markers, chest x-ray, and laboratory studies should not delay reperfusion therapy unless clinically necessary, for example, in suspected aortic dissection or coagulopathy.

**NEXT** 

**CHALLENGE US** 



# Self-Assessment













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# CONCURRENT ED OR CATH LAB ASSESSMENT

Perform a targeted evaluation, focusing on chest discomfort, signs and symptoms of heart failure, cardiac history, risk factors for ACS, and historical features that may preclude the use of fibrinolytics.

For a patient with STEMI, the goals of reperfusion are:

- · First medical contact to balloon inflation within 90 minutes.
- Door to drug (fibrinolytics) within 30 minutes of arrival.

The 12-lead ECG is at the center of the decision pathway in managing ischemic chest discomfort and is the only way to identify STEMI.

You can see an example ECG of an anterior STEMI below.



**PREVIOUS** 

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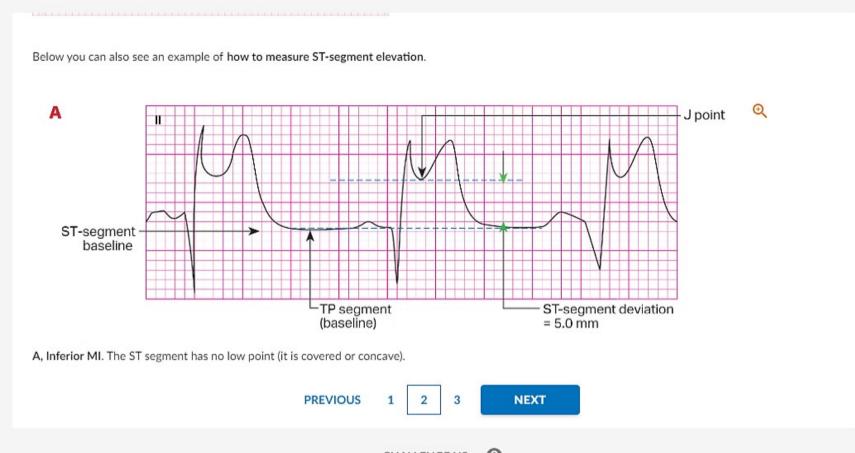
# Self-Assessment





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# CONCURRENT ED OR CATH LAB ASSESSMENT

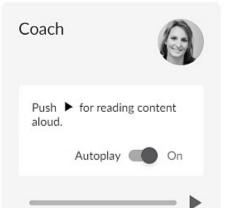


Self-Assessment

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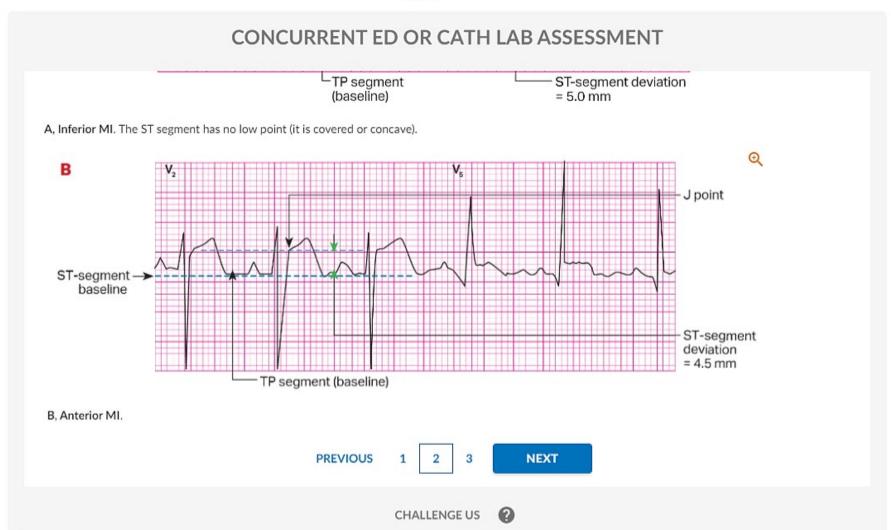




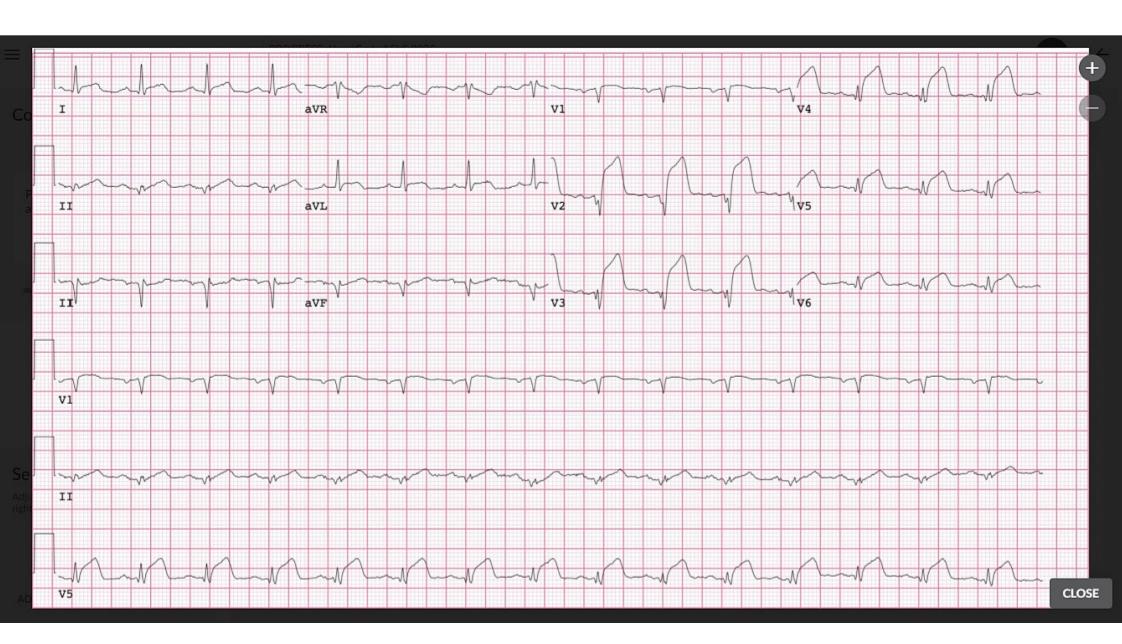


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# Self-Assessment Adjust your competence estimate to the right to focus on the questions ADVANCED BEGINNER



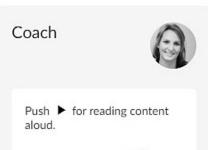
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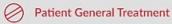






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# CONCURRENT ED OR CATH LAB ASSESSMENT



Unless allergies or contraindications exist, consider these 4 agents in patients with ischemic-type chest discomfort:

- If O<sub>2</sub> saturation is less than 90%, start oxygen at 4 L/min, titrate.
- Aspirin 162 to 325 mg (if not given by EMS).
- · Nitroglycerin sublingual or translingual.
- Morphine IV if discomfort not relieved by nitroglycerin.
- Consider administration of P2Y<sub>12</sub> inhibitors.

Because out-of-hospital providers may have given these agents already, administer initial or supplemental doses as indicated.

PREVIOUS

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**I KNEW** 

**GOT IT NOW** 

THINK I GOT IT

I DON'T GET IT



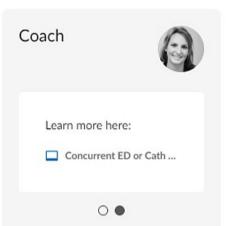


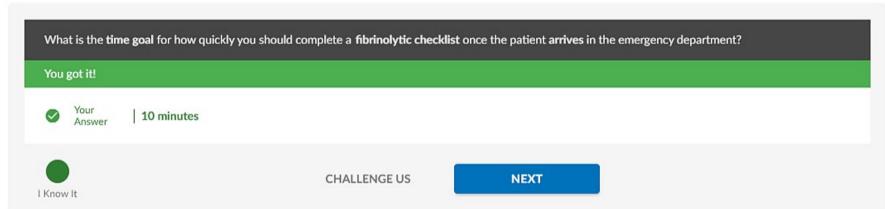


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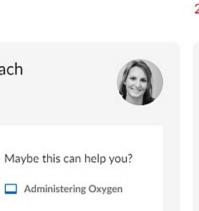


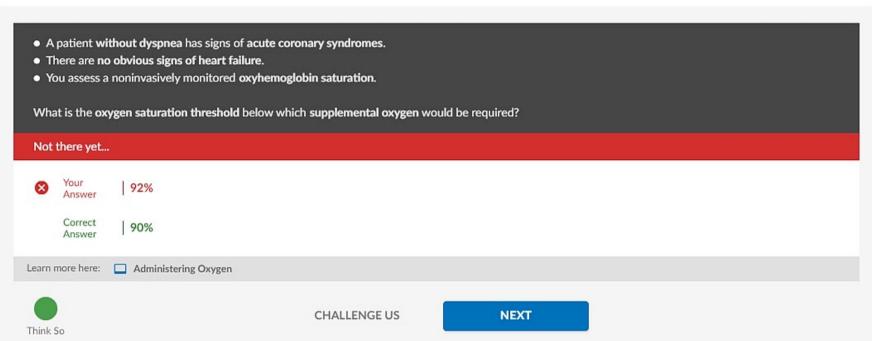




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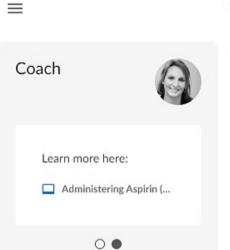
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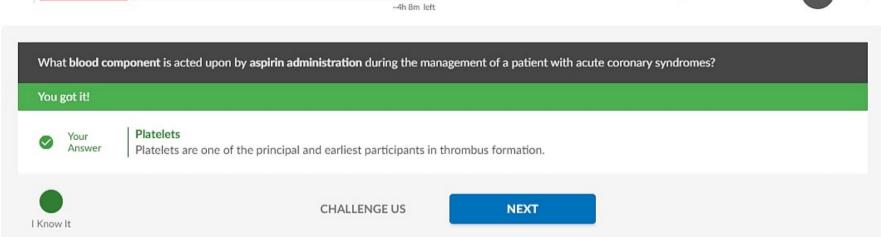


Administering Oxygen

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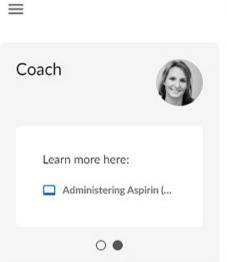
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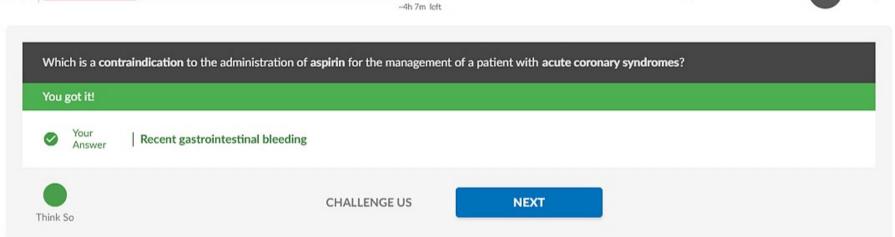




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# ADMINISTERING ASPIRIN (ACETYLSALICYLIC ACID)

A dose of 162 to 325 mg of non-enteric-coated or chewed aspirin causes immediate and near-total inhibition of thromboxane A<sub>2</sub> production by inhibiting platelet cyclooxygenase (COX-1).

Platelets are one of the principal and earliest participants in thrombus formation. This rapid inhibition also **reduces coronary reocclusion** and other recurrent events independently and after fibrinolytic therapy.



## How to Give Aspirin

If the patient has not taken aspirin and has no history of true aspirin allergy and no evidence of recent GI bleeding, give the patient aspirin (162 to 325 mg) to chew. In the initial hours of an ACS, aspirin is absorbed better when chewed than when swallowed, particularly if the patient has received morphine.

Use rectal aspirin suppositories (300 mg) for patients with nausea, vomiting, active peptic ulcer disease, or other disorders of the upper GI tract.

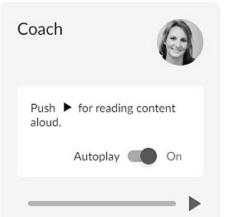
Aspirin is associated with a reduction in mortality for patients with ACS.













# Indications for initiating IV nitroglycerin in STEMI

- Recurrent or continuing chest discomfort unresponsive to sublingual or translingual nitroglycerin
- · Pulmonary edema complicating STEMI
- Hypertension complicating STEMI

hemodynamics and clinical condition.

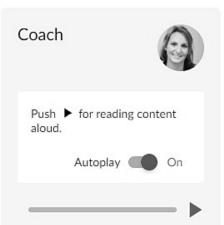


I KNEW GOT IT NOW THINK I GOT IT I DON'T GET IT

CHALLENGE US



Self-Assessment



# ADMINISTERING NITROGLYCERIN (GLYCERYL TRINITRATE)

Nitroglycerin effectively reduces ischemic chest discomfort, and it has beneficial hemodynamic effects. The physiologic effects of nitrates reduce left ventricular (LV) and right ventricular (RV) preload through peripheral arterial and venous dilation.

# 0

# How to Give Nitroglycerin

Give the patient 1 sublingual nitroglycerin tablet (or translingual dose) every 3 to 5 minutes for ongoing symptoms if permitted by medical control and no contraindications exist. You may repeat the dose twice (total of 3 doses).

Administer nitroglycerin only if the patient remains hemodynamically stable: systolic blood pressure (SBP) greater than 90 mm Hg or no lower than 30 mm Hg below baseline (if known) and a heart rate of 50 to 100/min.

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Self-Assessment



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# ADMINISTERING NITROGLYCERIN (GLYCERYL TRINITRATE)

Nitroglycerin is a venodilator; use it cautiously or not at all in patients with inadequate ventricular preload. These situations include

- Inferior wall MI and RV infarction. RV infarction may complicate an inferior wall MI. Patients with acute RV infarction depend on RV filling pressures to
  maintain cardiac output and blood pressure. If you cannot rule out RV infarction, use caution in administering nitrates to patients with an inferior STEMI. If
  you confirm RV infarction by right-sided precordial leads, or if an experienced provider confirms it through clinical findings, then nitroglycerin and other
  vasodilators, such as morphine, or volume-depleting drugs (diuretics) are contraindicated as well.
- Hypotension, bradycardia, or marked tachycardia. Avoid using nitroglycerin in patients with hypotension (SBP less than 90 mm Hg), marked bradycardia (less than 50/min), or tachycardia.
- Recent phosphodiesterase inhibitor use. Avoid using nitroglycerin if you suspect or know that the patient has taken sildenafil or vardenafil within the
  previous 24 hours or tadalafil within 48 hours. These agents are generally used for erectile dysfunction or in cases of pulmonary hypertension, and in
  combination with nitrates, they may cause severe hypotension refractory to vasopressor agents.

**PREVIOUS** 

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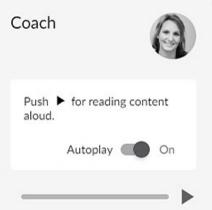
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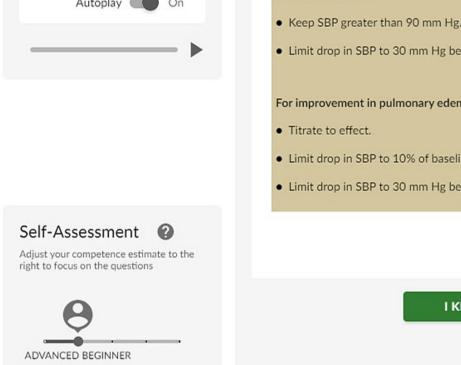


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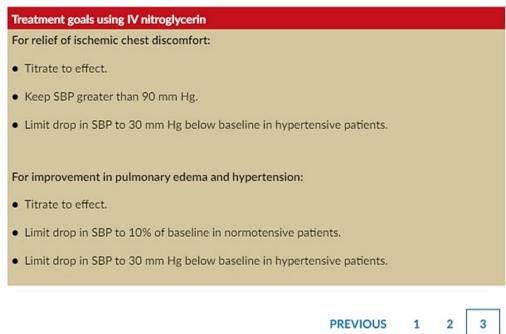








# ADMINISTERING NITROGLYCERIN (GLYCERYL TRINITRATE)



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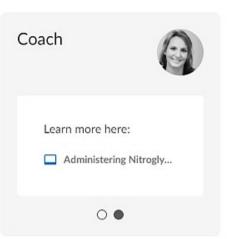
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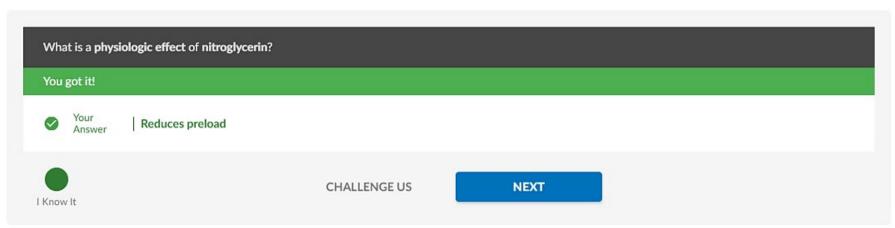








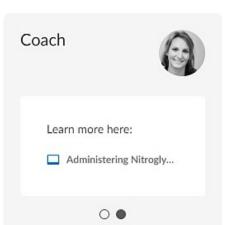


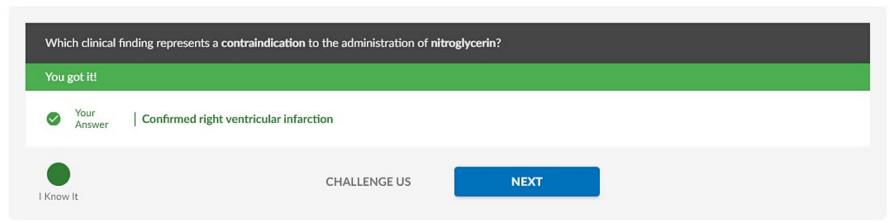
















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# ADMINISTERING MORPHINE

## Indications

Consider administering morphine for severe chest discomfort that does not respond to sublingual or translingual nitroglycerin, if authorized by protocol or medical control. Healthcare providers can consider giving analgesics such as morphine while monitoring the patient's blood pressure and respiratory rate. Morphine is indicated in STEMI when chest discomfort does not respond to nitrates.

Use morphine with caution in NSTE-ACS because of an association with increased mortality.

In addition, morphine may mask symptoms of myocardial ischemia and decrease absorption of important orally administered drugs, such as antiplatelets (P2Y<sub>12</sub> receptor blockers). Use morphine with caution for patients with unstable angina.

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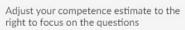
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# Self-Assessment ②







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# Self-Assessment



Adjust your competence estimate to the right to focus on the questions



# **ADMINISTERING MORPHINE**

# Physiologic Effects

Morphine may be used to manage ACS because it

- · Produces central nervous system analgesia, which reduces the adverse effects of neurohumoral activation, catecholamine release, and heightened myocardial oxygen demand
- Alleviates dyspnea
- · Produces venodilation, which reduces LV preload and oxygen requirement
- Decreases systemic vascular resistance, which reduces LV afterload
- · Helps redistribute blood volume in patients with acute pulmonary edema

Remember, morphine is a venodilator. As with nitroglycerin, use smaller doses and carefully monitor physiologic response before administering additional doses in patients who may be preload dependent. If hypotension develops, administer fluids as a first line of therapy.

**PREVIOUS** 





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I DON'T GET IT

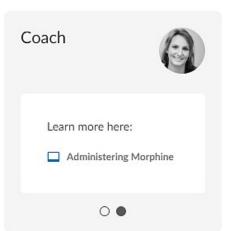


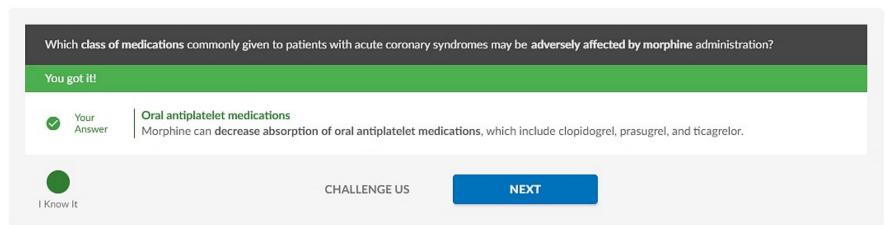


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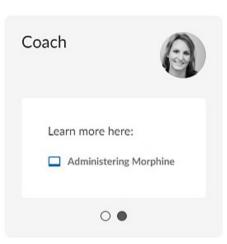




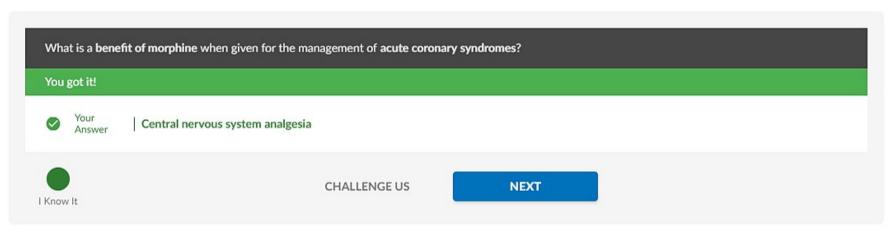








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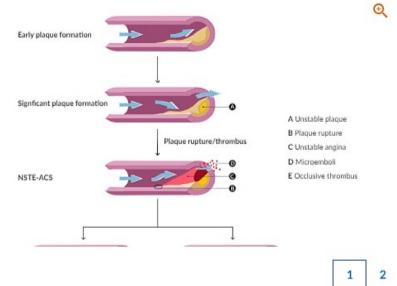


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# CLASSIFYING PATIENTS BASED ON ST-SEGMENT DEVIATION

Patients with coronary atherosclerosis may develop a spectrum of clinical syndromes that represent varying degrees of coronary artery occlusion. These syndromes include non-ST-segment elevation ACS, or NSTE-ACS, and ST-segment elevation myocardial infarction, or STEMI. Sudden cardiac death may occur with any of these syndromes. The figure illustrates the pathophysiology of ACS.



NEXT

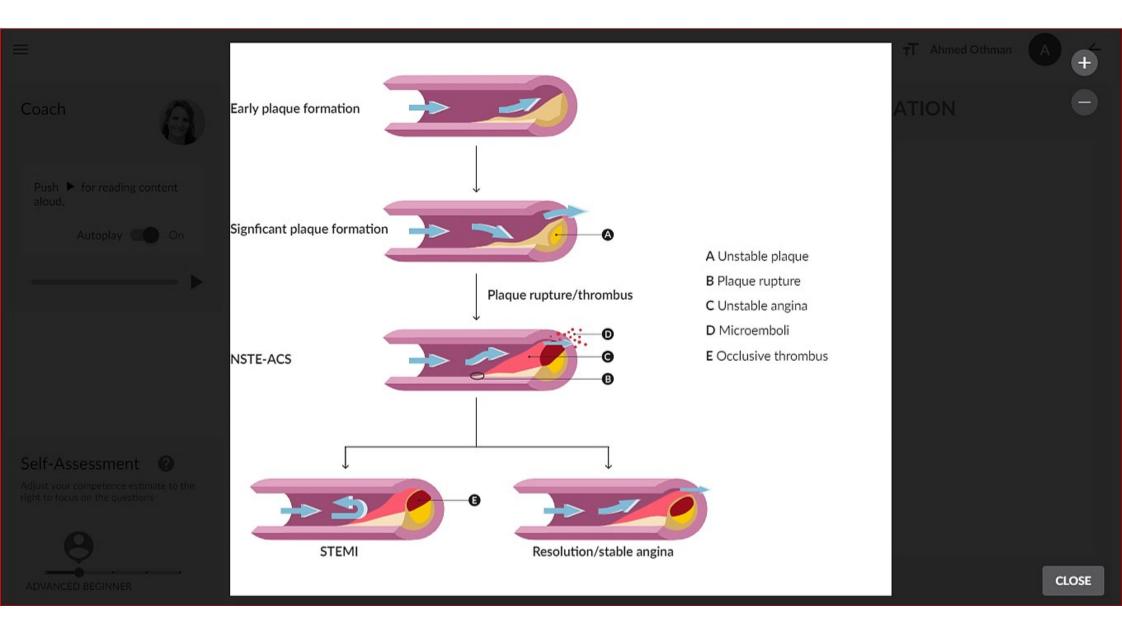
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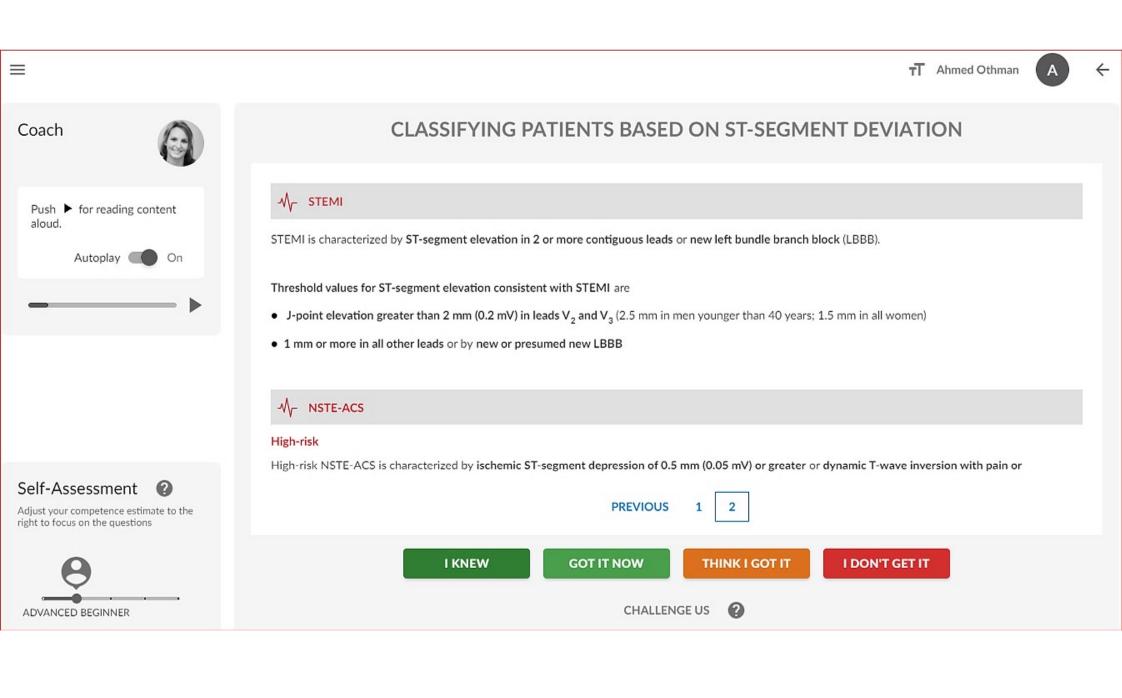


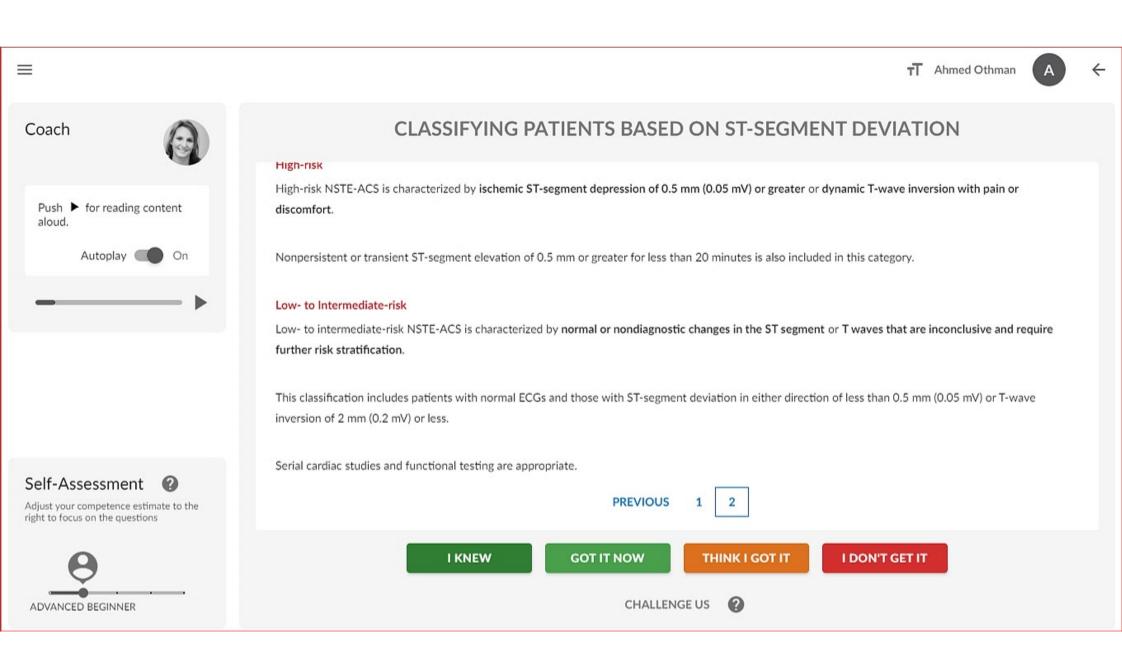


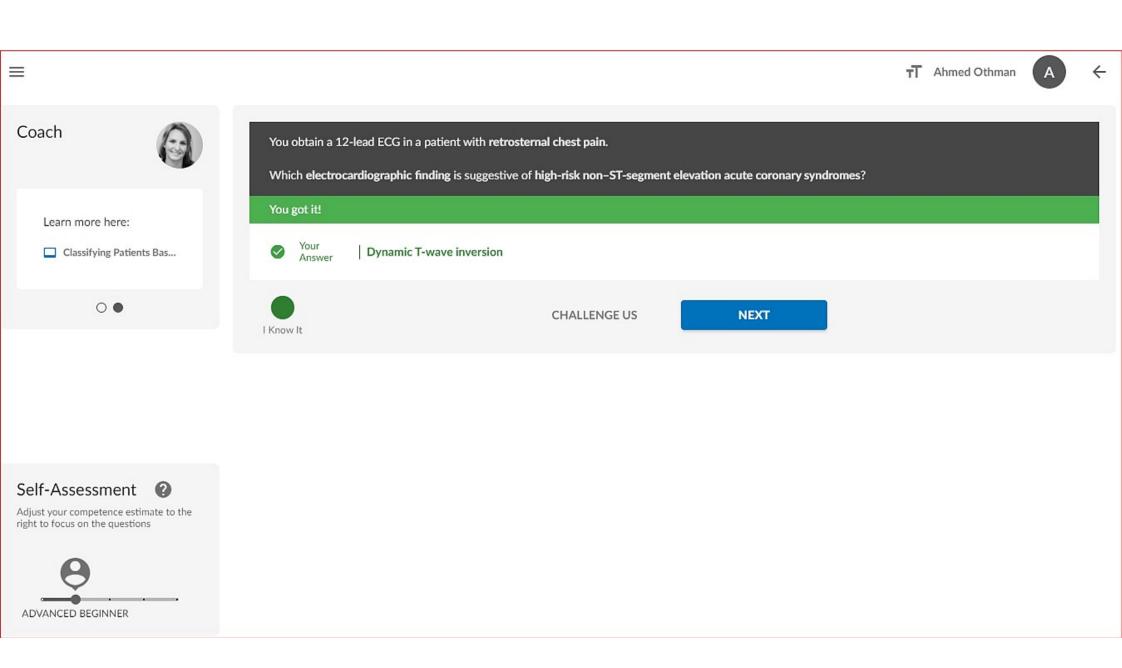
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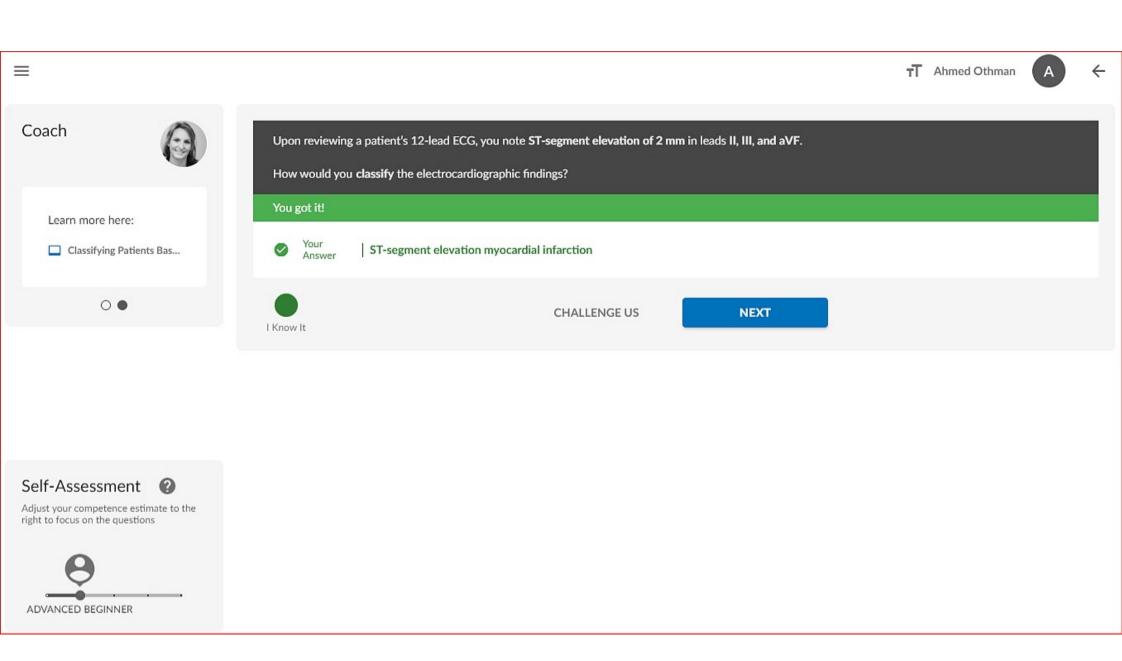
























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## TREATMENT STRATEGIES FOR ACS PATIENTS

#### Strategies

Patients with STEMI usually have complete occlusion of an epicardial coronary artery. Treat STEMI by providing early reperfusion therapy achieved with primary percutaneous coronary intervention(or PCI) or fibrinolytics. Reperfusion therapy opens an obstructed coronary artery with either mechanical means or drugs.

PCI, performed in the cardiac catheterization laboratory after coronary angiography, allows balloon dilation and/or stent placement for an obstructed coronary artery.

Early fibrinolytic therapy or direct catheter-based reperfusion is an established standard of care for patients with STEMI who present within 12 hours after symptom onset with no contraindications.

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#### Recommended time frames

Early Reperfusion Therapy

- For PCI, the goal is first medical contact-to-balloon inflation time of 90 minutes or less.
- For patients at a non-PCI-capable hospital, time from first medical contact to device should be less than 120 minutes when considering primary PCI, but systems should strive to achieve the shortest time possible.
- If fibrinolysis is the intended reperfusion, the longest acceptable ED door-to-needle time (needle time is the beginning of infusion of a fibrinolytic agent) is 30 minutes, but systems should strive to achieve the shortest time possible.

**PREVIOUS** 



TREATMENT STRATEGIES FOR ACS PATIENTS

Rapidly identify patients with STEMI and use a fibrinolytic checklist to screen for indications and contraindications to fibrinolytic therapy, if appropriate.

The first qualified physician who encounters a patient with STEMI should interpret or confirm the 12-lead ECG, determine the risk/benefit of reperfusion therapy, and direct administration of fibrinolytic therapy or activation of the PCI team. Early activation of PCI may occur with established protocols.

NEXT

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Self-Assessment

Adjust your competence estimate to the right to focus on the questions

ADVANCED BEGINNER













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#### Recommended time frames

- For PCI, the goal is first medical contact-to-balloon inflation time of 90 minutes or less.
- For patients at a non-PCI-capable hospital, time from first medical contact to device should be less than 120 minutes when considering primary PCI, but systems should strive to achieve the shortest time possible.
- If fibrinolysis is the intended reperfusion, the longest acceptable ED door-to-needle time (needle time is the beginning of infusion of a fibrinolytic agent) is 30 minutes, but systems should strive to achieve the shortest time possible.
- · Consider patients who are ineligible for fibrinolytic therapy for transfer to a PCI facility, regardless of delay, but prepare for a door-to-departure time of 30 minutes.

Self-Assessment



Adjust your competence estimate to the right to focus on the questions



**PREVIOUS** 



TREATMENT STRATEGIES FOR ACS PATIENTS

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**NEXT** 





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# TREATMENT STRATEGIES FOR ACS PATIENTS

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#### Choosing Primary PCI

The most common form of PCI is coronary angioplasty with stent placement, and primary PCI is preferred over fibrinolytic administration. Many studies have shown PCI to be superior to fibrinolysis in the combined end points of death, stroke, and reinfarction for patients presenting between 3 and 12 hours after onset.

Interventional strategies for the management of STEMI are as follows:

Primary PCI: The patient is taken to the catheterization laboratory for PCI immediately after hospital presentation.

**Rescue PCI:** The patient is initially treated with fibrinolytic therapy. The patient does not show signs of reperfusion (lack of ST resolution more than 50% after 1 hour of fibrinolytic therapy administration) and therefore is referred for rescue PCI.

Pharmacoinvasive strategy: The patient is initially treated with fibrinolytic therapy with the intention to perform coronary angiography and PCI, if appropriate.

# Self-Assessment



Adjust your competence estimate to the right to focus on the questions



ADVANCED BEGINNER

#### Considerations for the use of primary PCI

PCI is the treatment of choice for the management of STEMI when it can be performed effectively with a
first medical contact-to-balloon inflation time of 90 minutes or less by a skilled provider at a skilled PCI

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T Ahmed Othman





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# Self-Assessment



Adjust your competence estimate to the right to focus on the questions



### TREATMENT STRATEGIES FOR ACS PATIENTS

1 hour of fibrinolytic therapy administration) and therefore is referred for rescue PCI.

Pharmacoinvasive strategy: The patient is initially treated with fibrinolytic therapy with the intention to perform coronary angiography and PCI, if appropriate.

#### Considerations for the use of primary PCI

- PCI is the treatment of choice for the management of STEMI when it can be performed effectively with a
  first medical contact-to-balloon inflation time of 90 minutes or less by a skilled provider at a skilled PCI
  facility.
- Primary PCI may also be offered to patients presenting to non-PCI-capable centers if PCI can be initiated
  promptly within 120 minutes after first medical contact.
- For patients admitted to a non-PCI center, transferring for PCI vs administering on-site fibrinolytics may have some benefit in terms of reinfarction, stroke, and a trend to lower mortality when PCI is performed within 120 minutes after first medical contact.
- PCI is also preferred in patients with contraindications to fibrinolytics and is indicated in patients with highrisk features, heart failure complicating MI, or cardiogenic shock.

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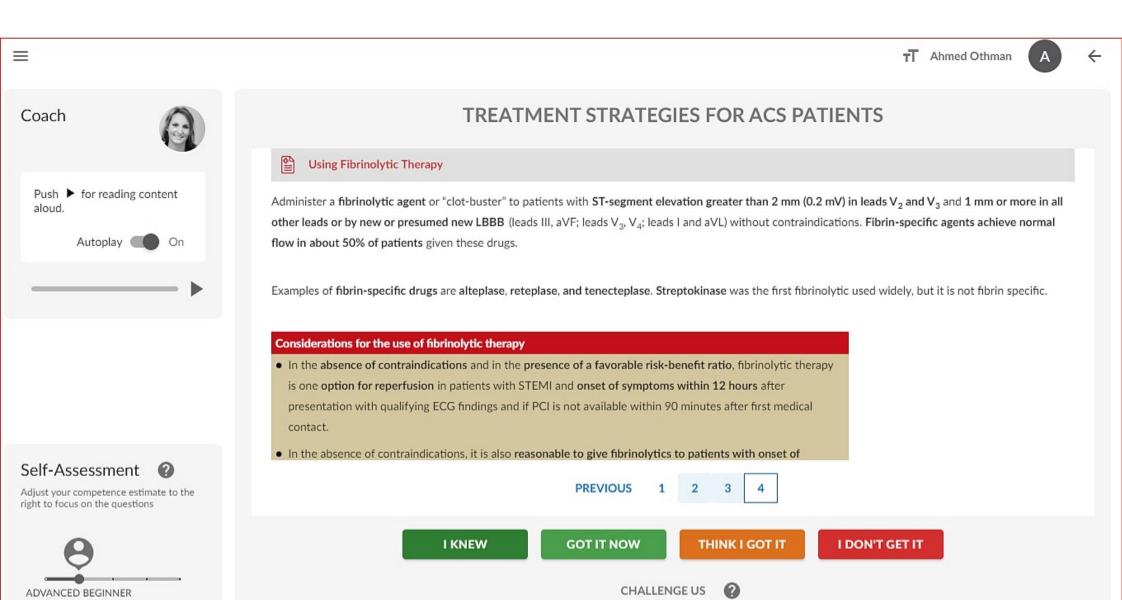
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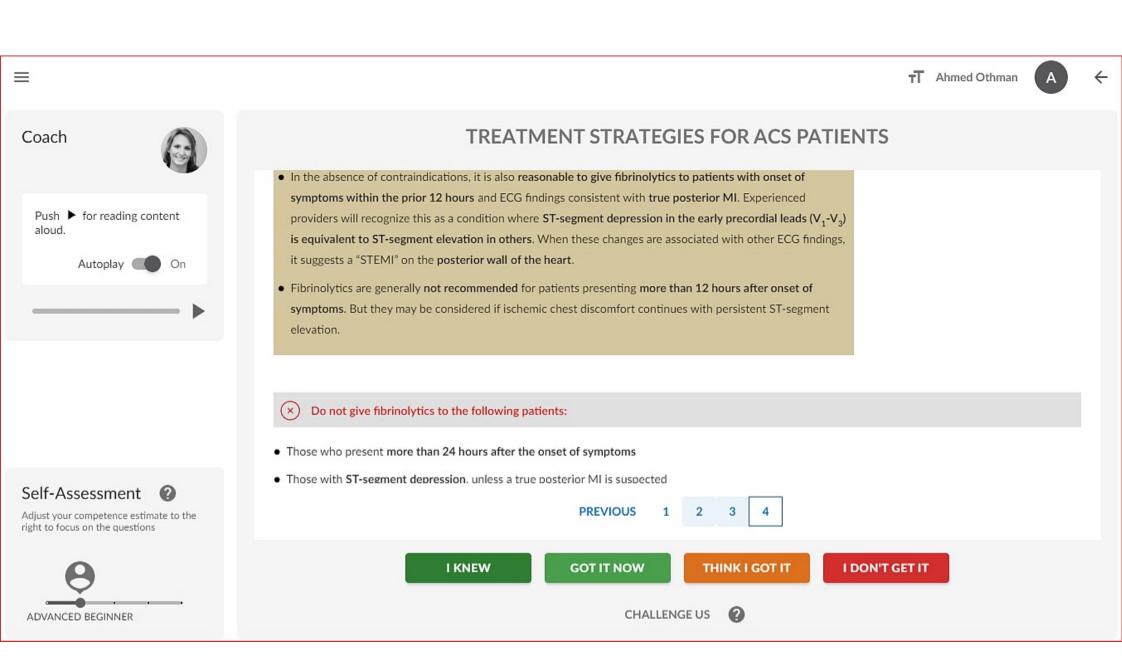
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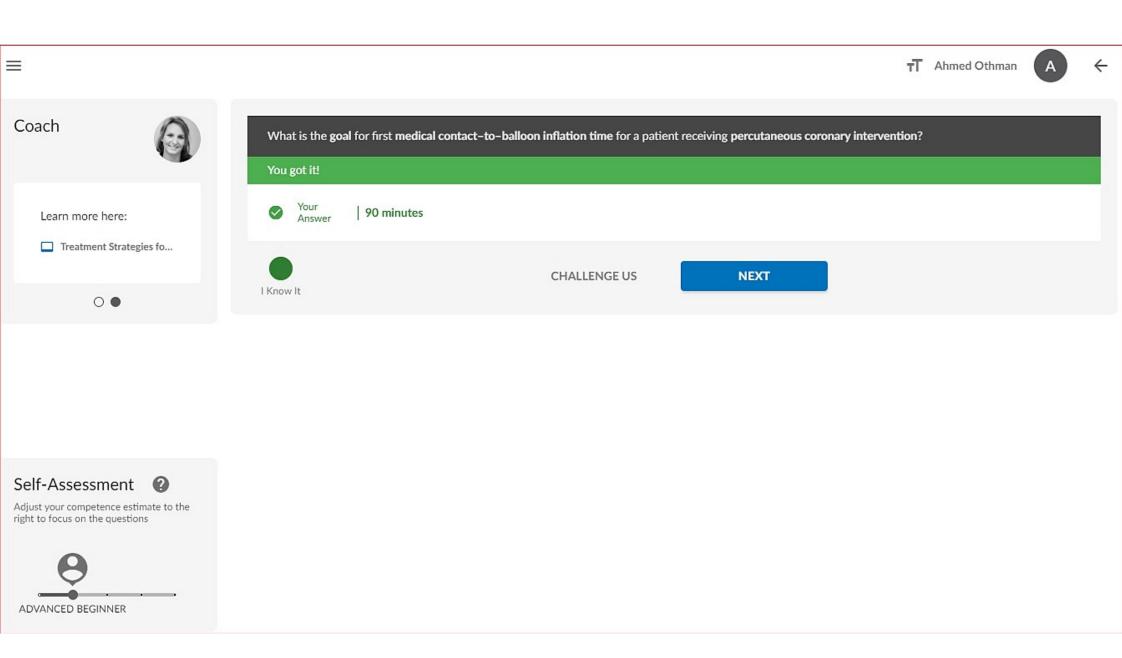
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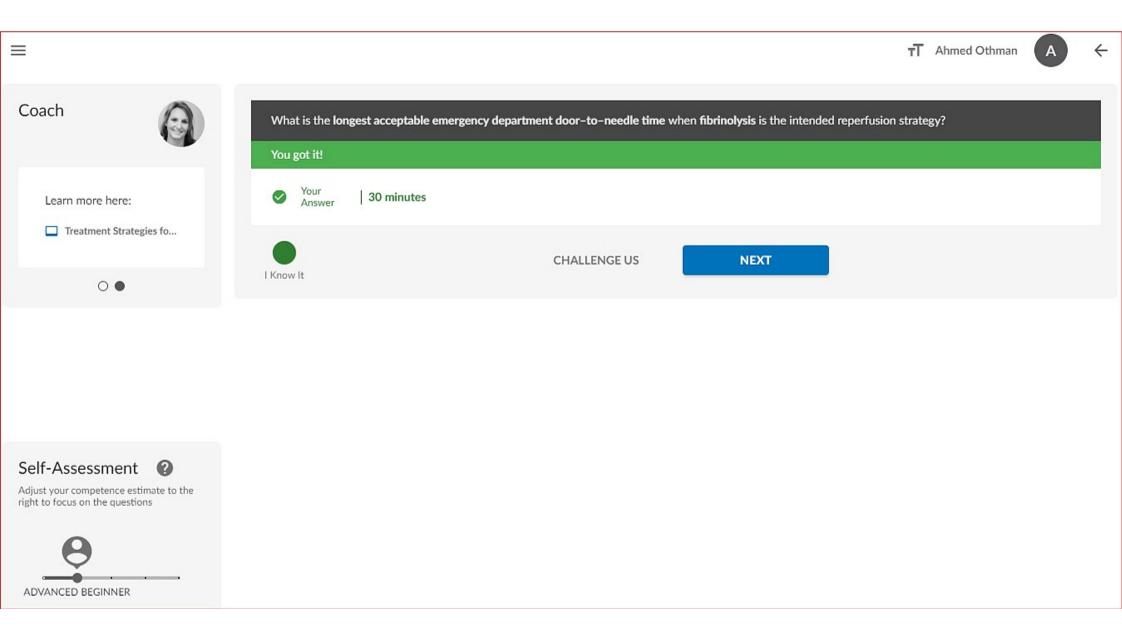


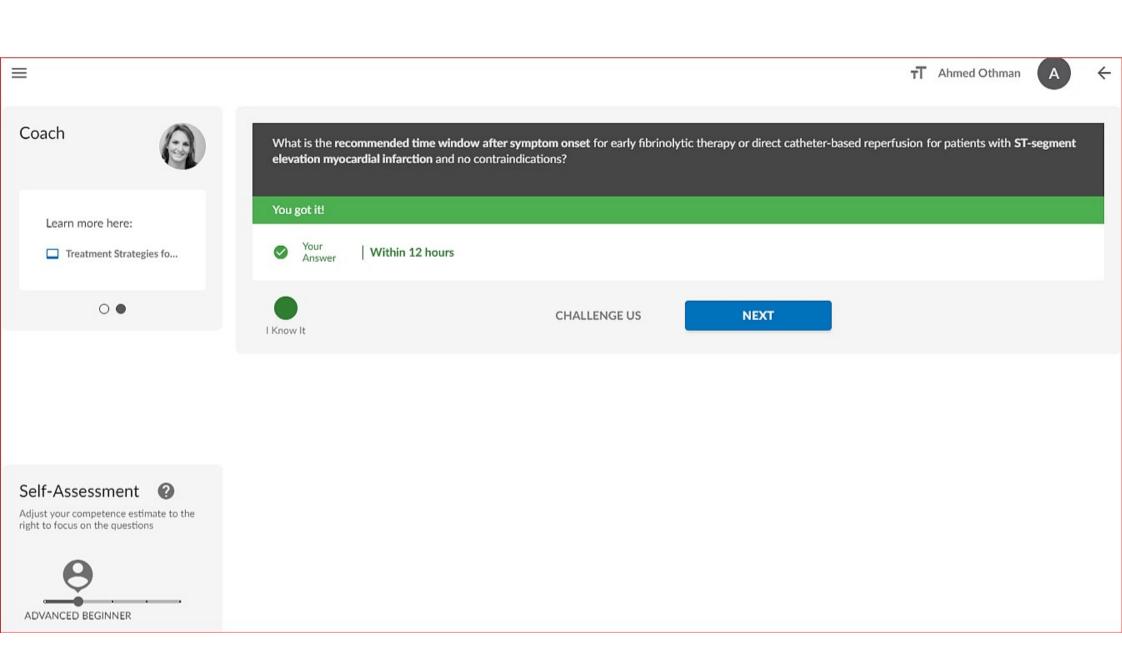
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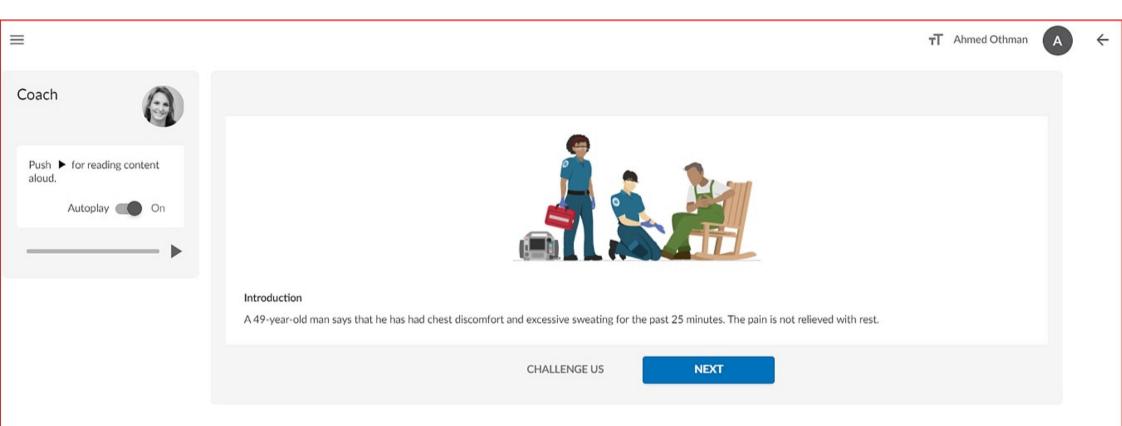




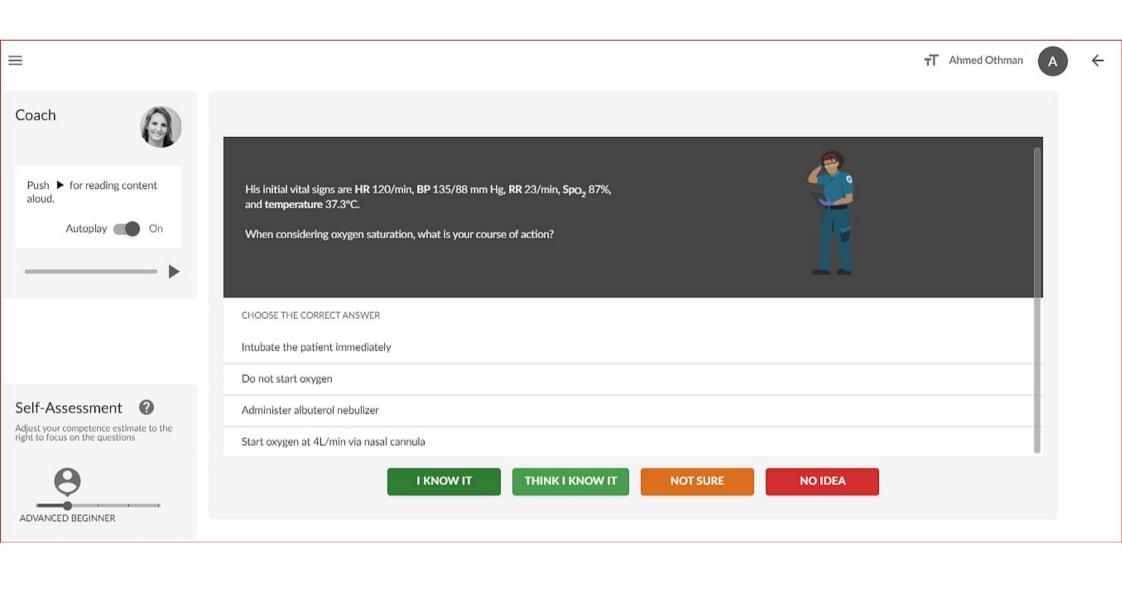






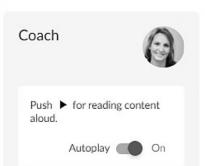


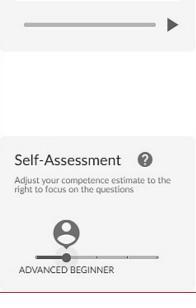


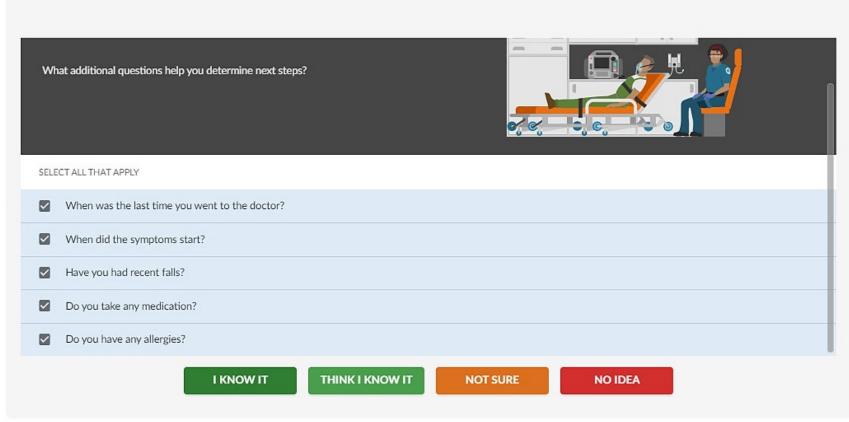


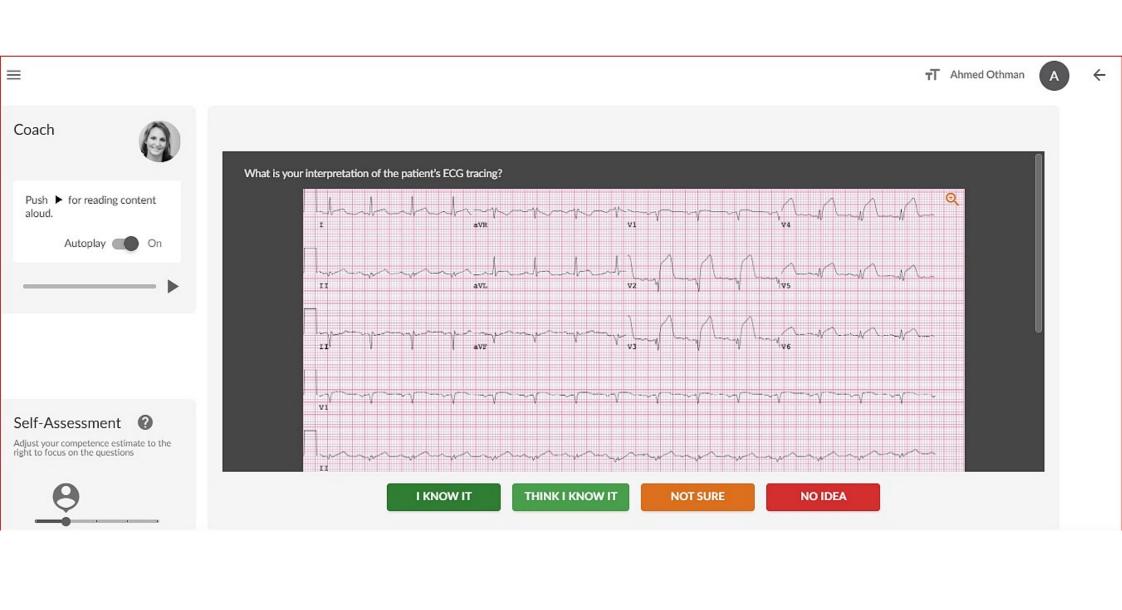


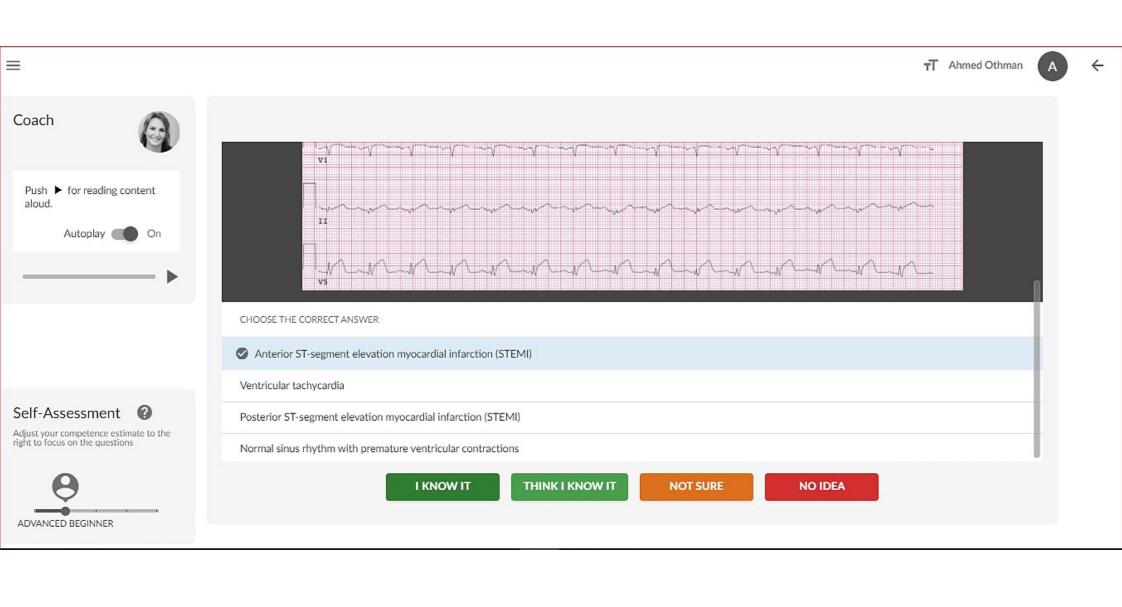


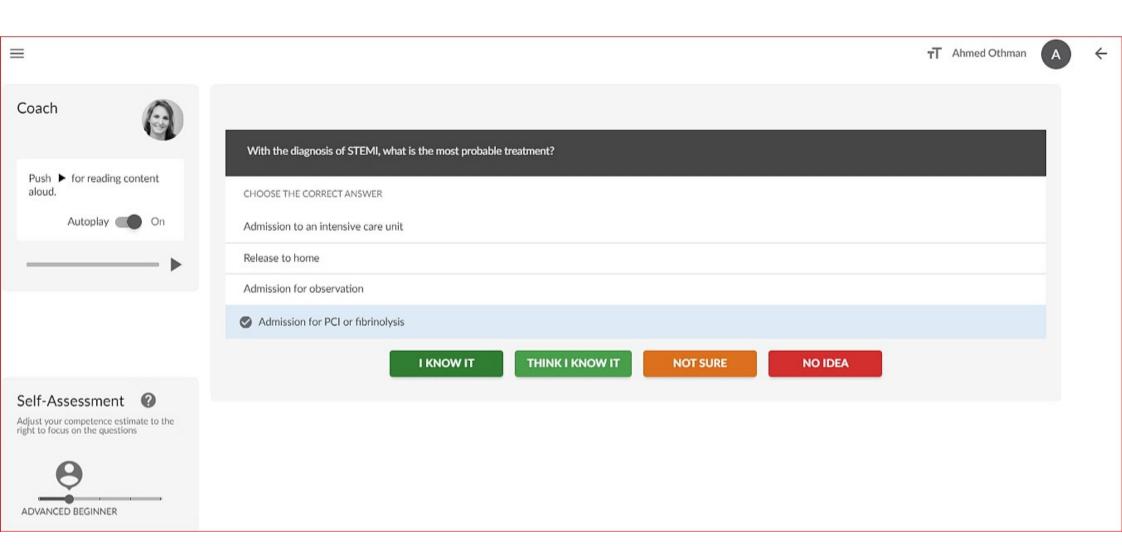


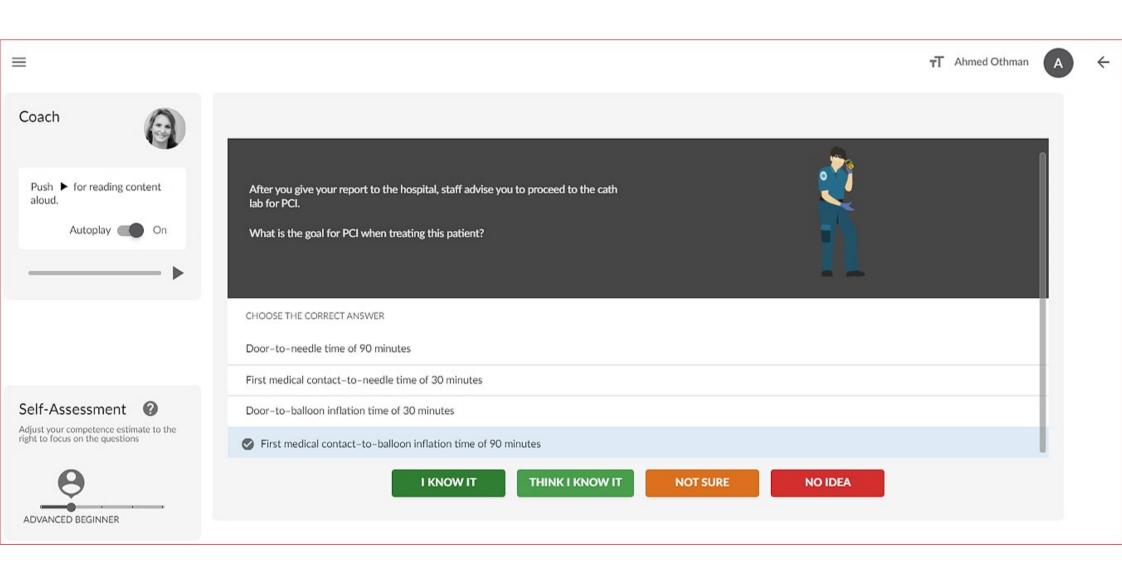


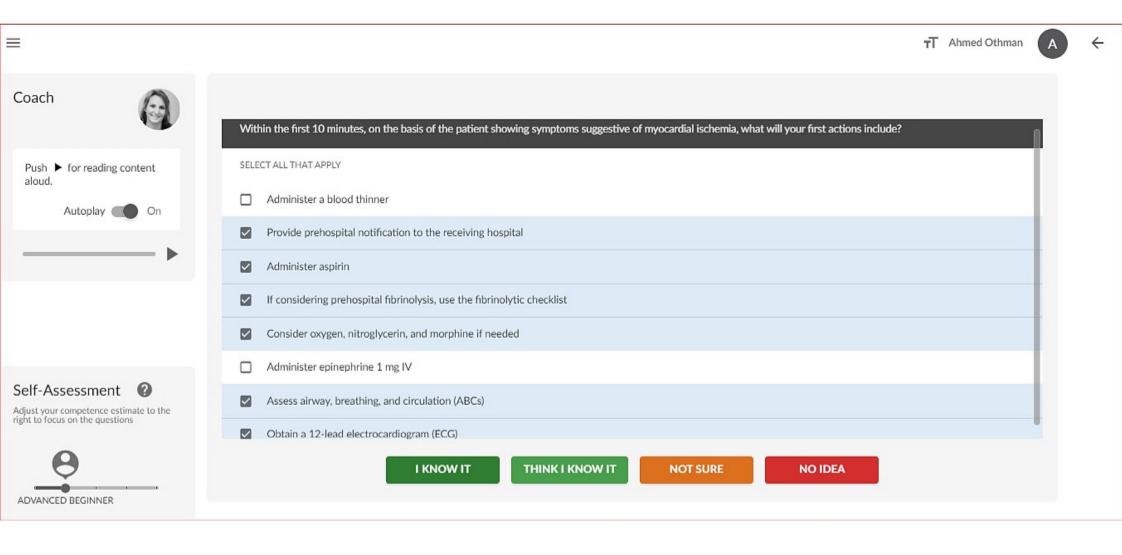


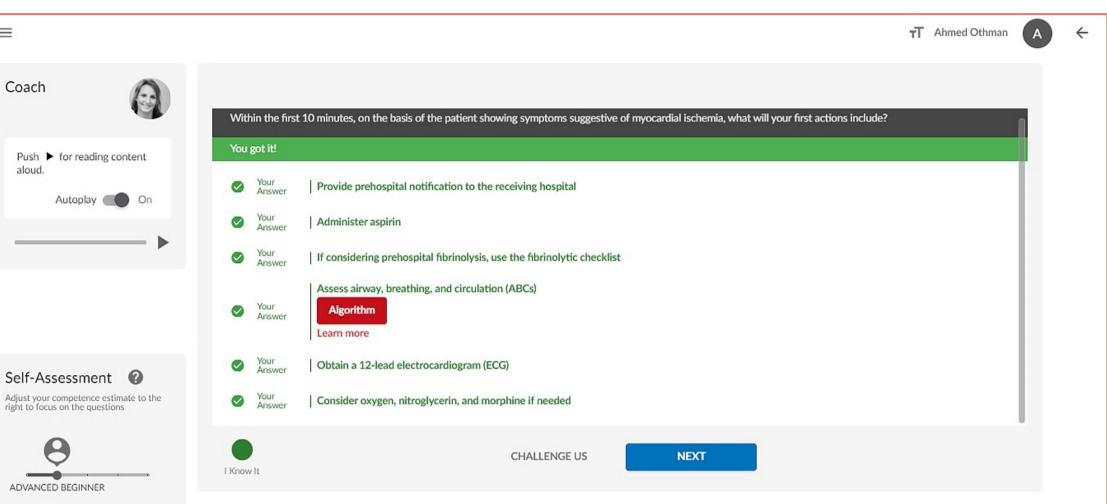












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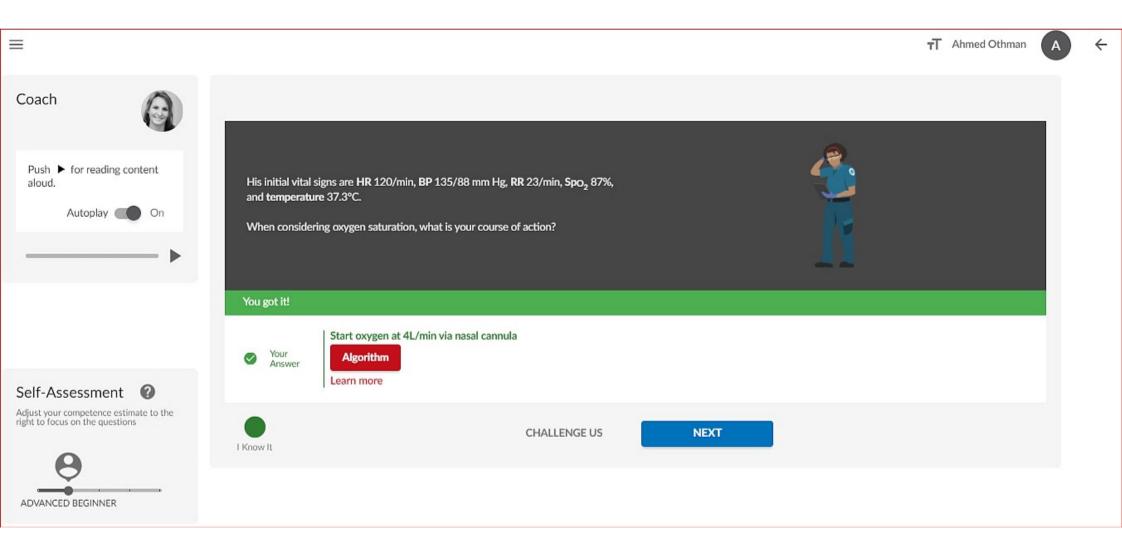
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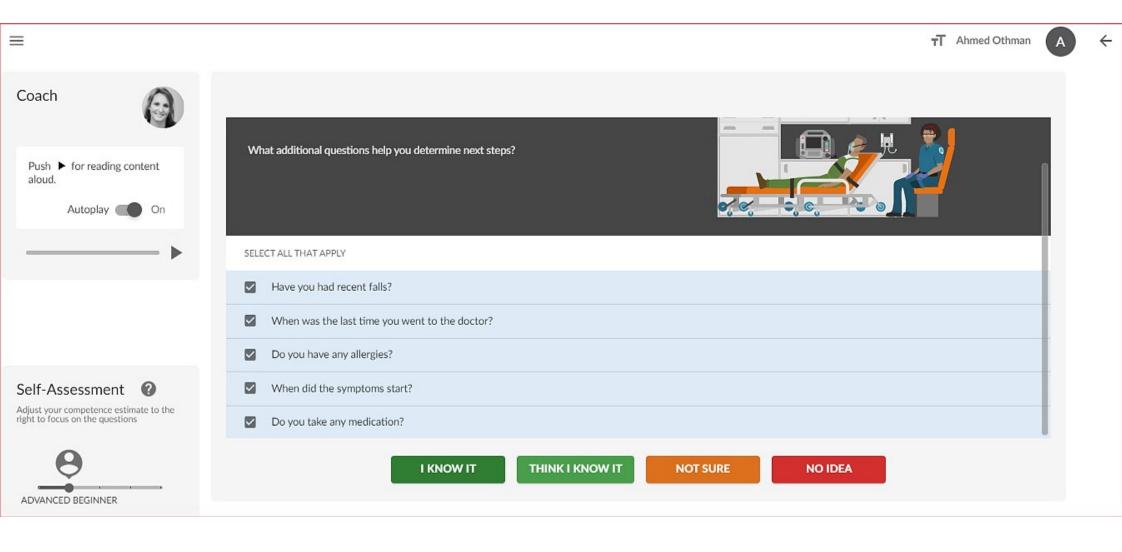
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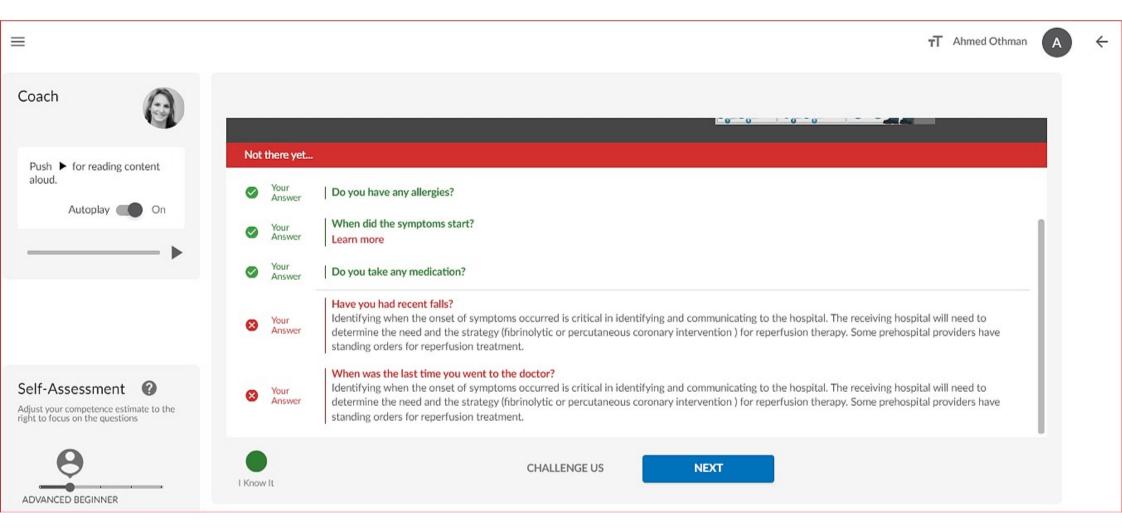
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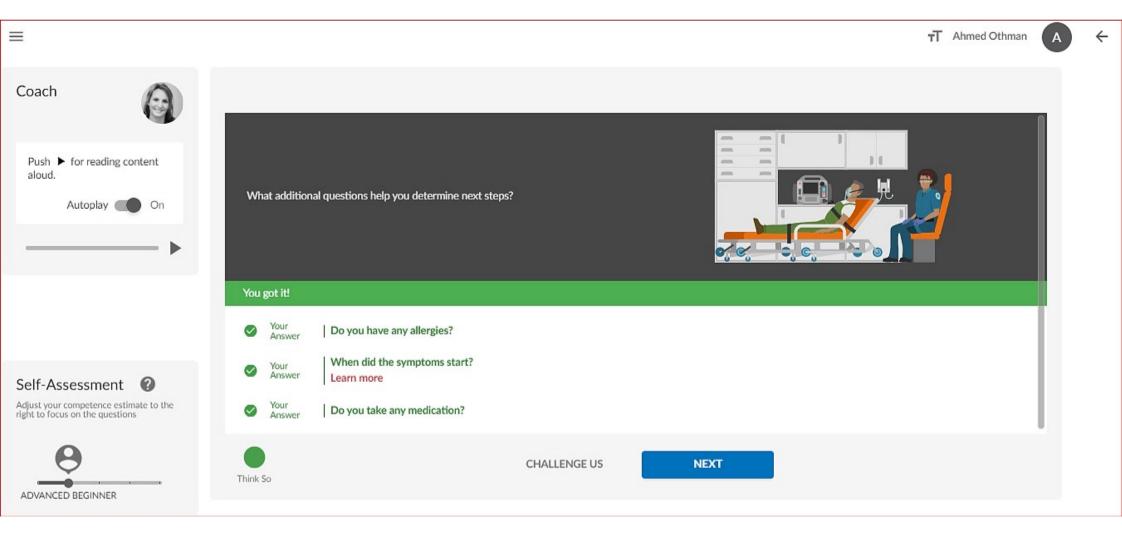
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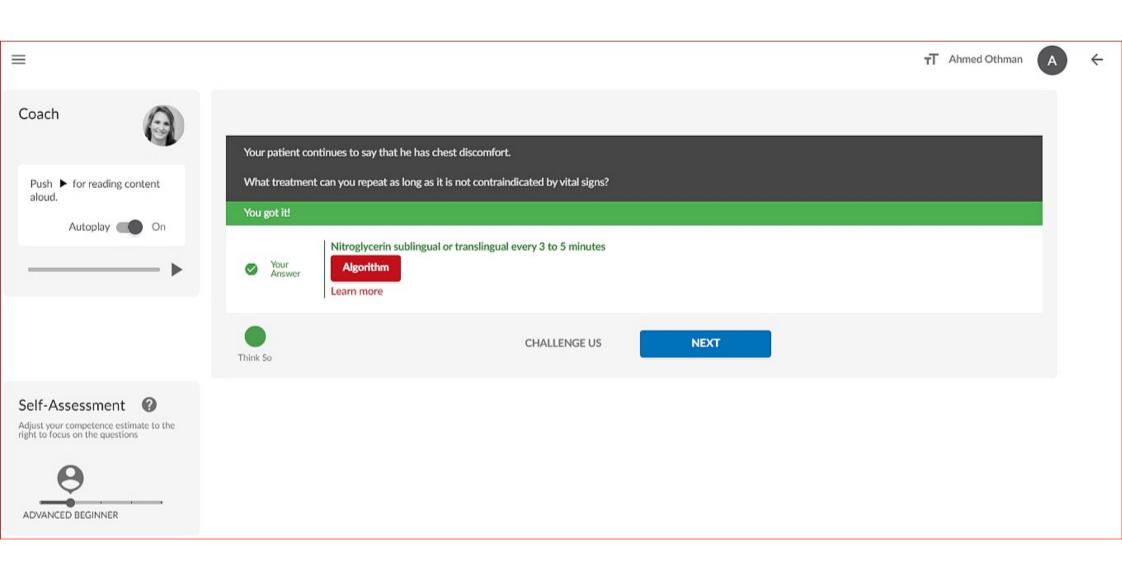
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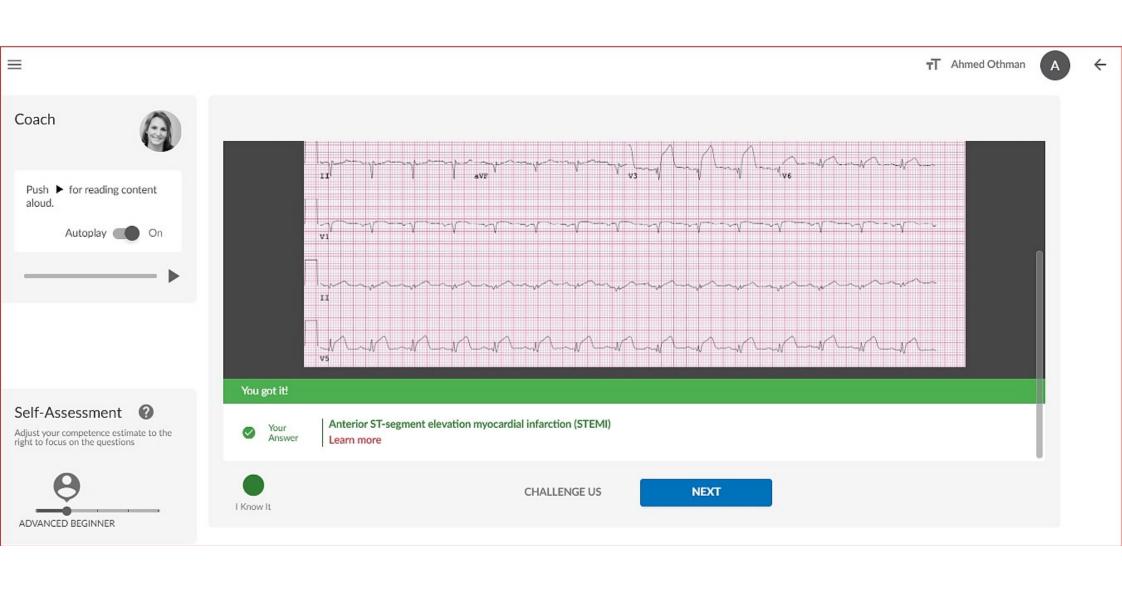


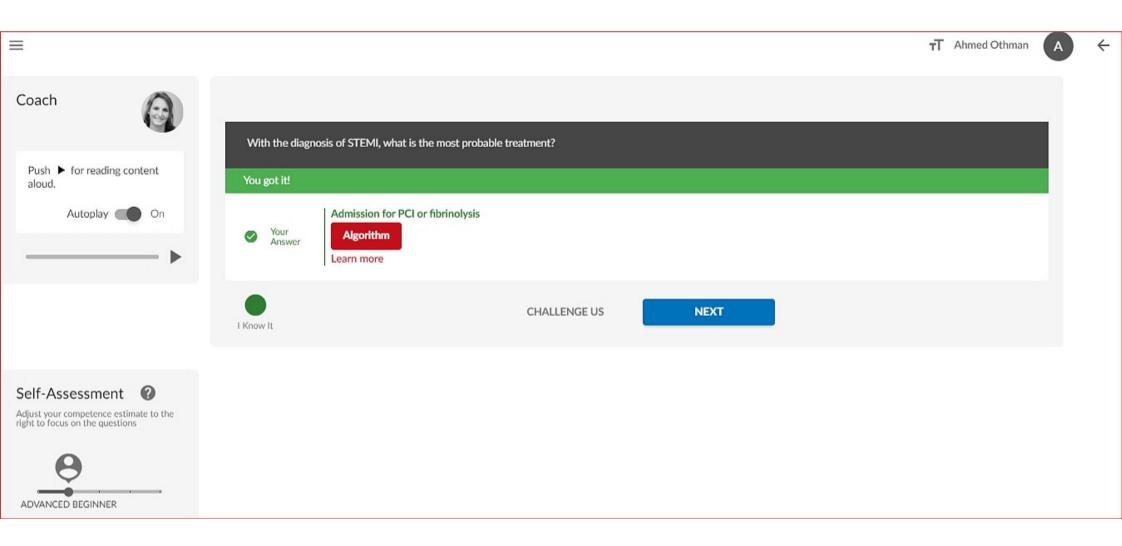


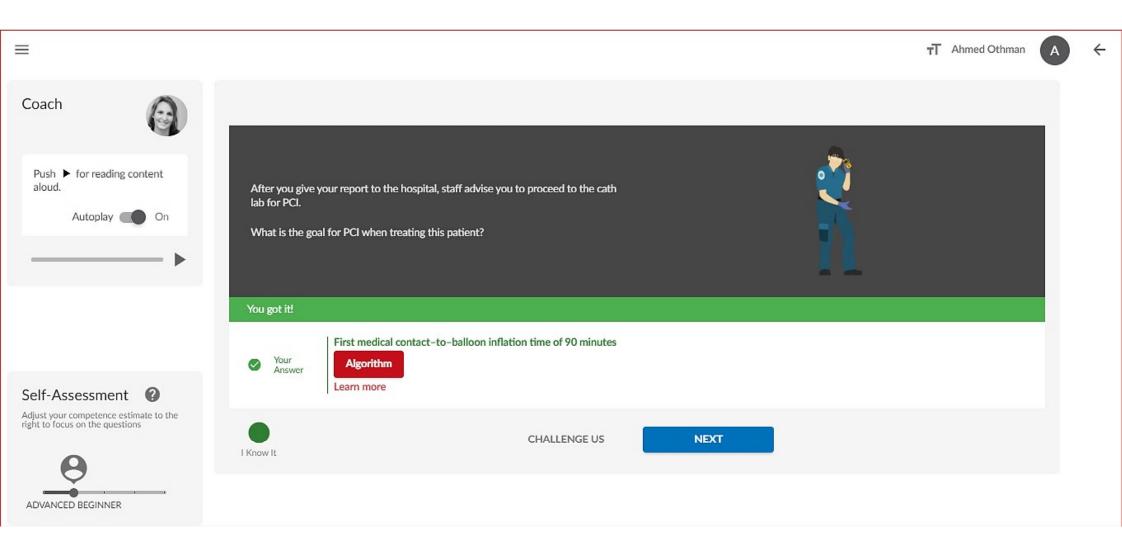


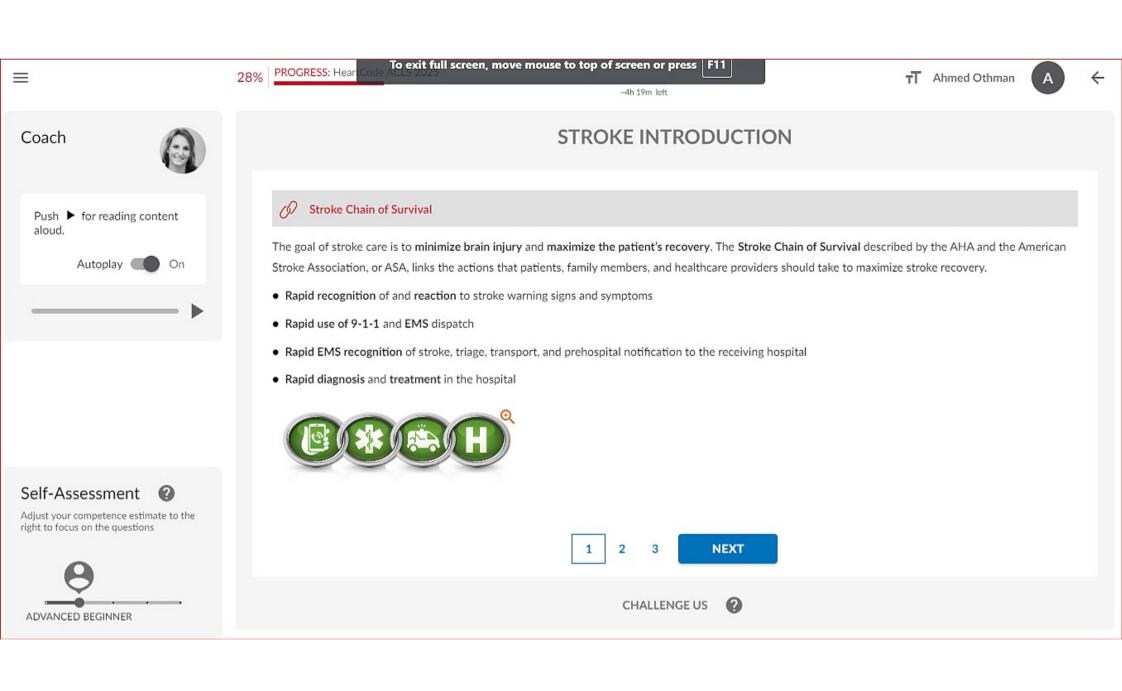




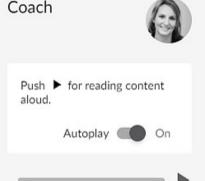












The 8 D's of Stroke Care

The 8 D's of Stroke Care highlight the major steps in diagnosis and treatment of stroke and key points at which delays can occur:

- Detection: rapid recognition of stroke signs and symptoms
- Dispatch: early activation and dispatch of EMS by phoning 9-1-1
- Delivery: rapid EMS stroke identification, management, triage, transport, and prehospital notification
- Door: emergent ED/imaging suite triage and immediate assessment by the stroke team
- · Data: rapid clinical evaluation, laboratory testing, and brain imaging
- Decision: establishing stroke diagnosis and determining optimal therapy selection
- Drug/Device: administration of fibrinolytic and/or endovascular therapy if eligible
- Disposition: rapid admission to the stroke unit or critical care unit, or emergent interfacility transfer for endovascular therapy (or EVT)

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Self-Assessment

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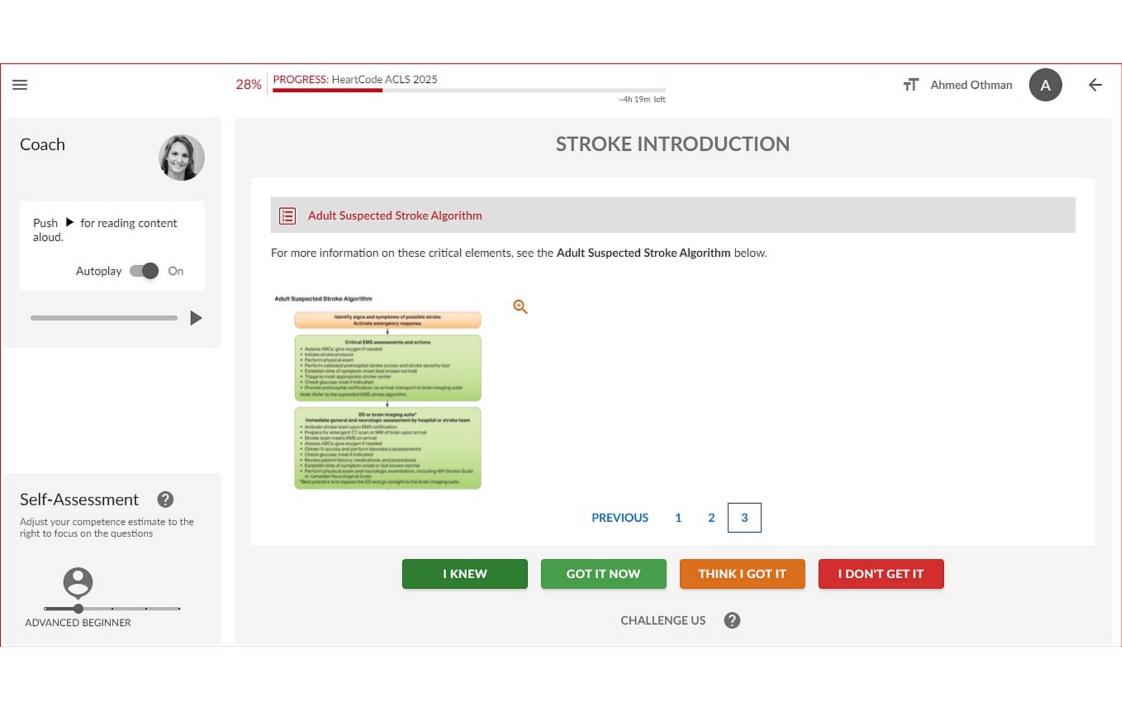
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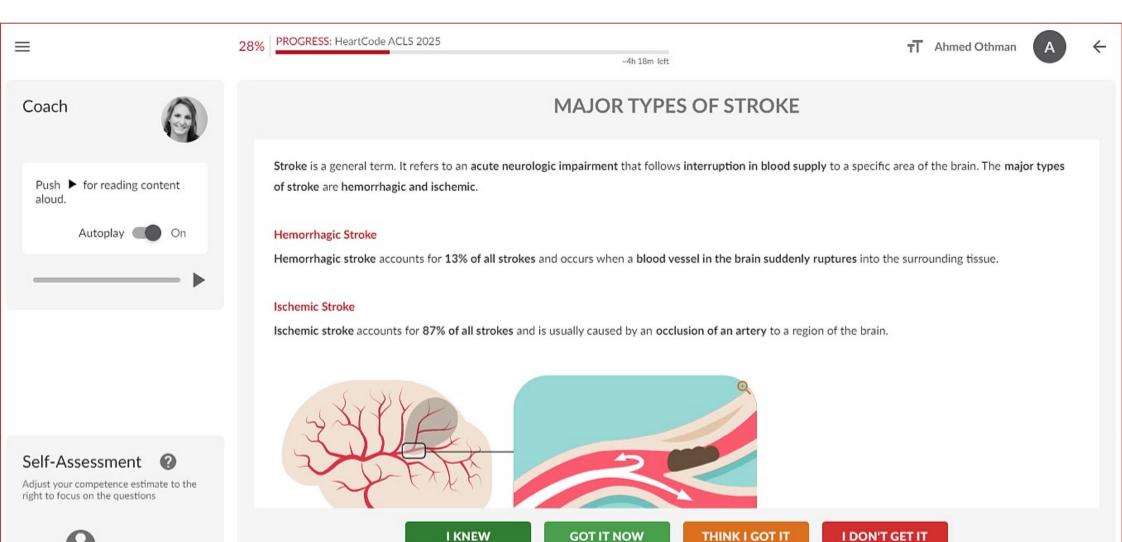
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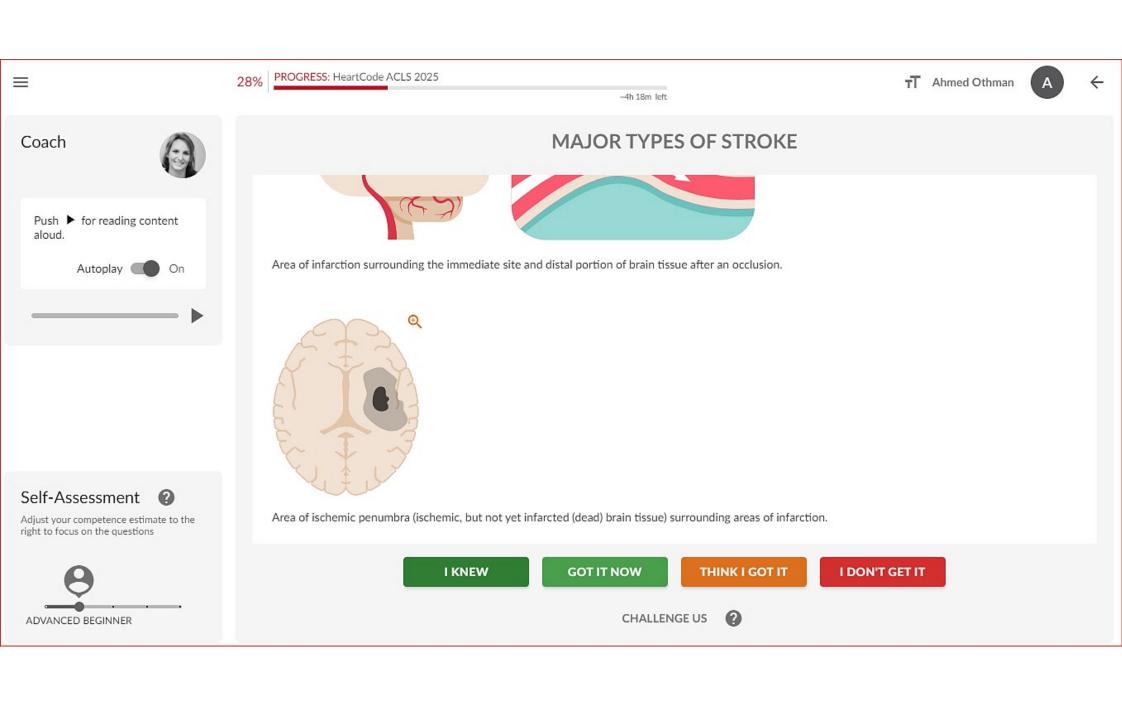


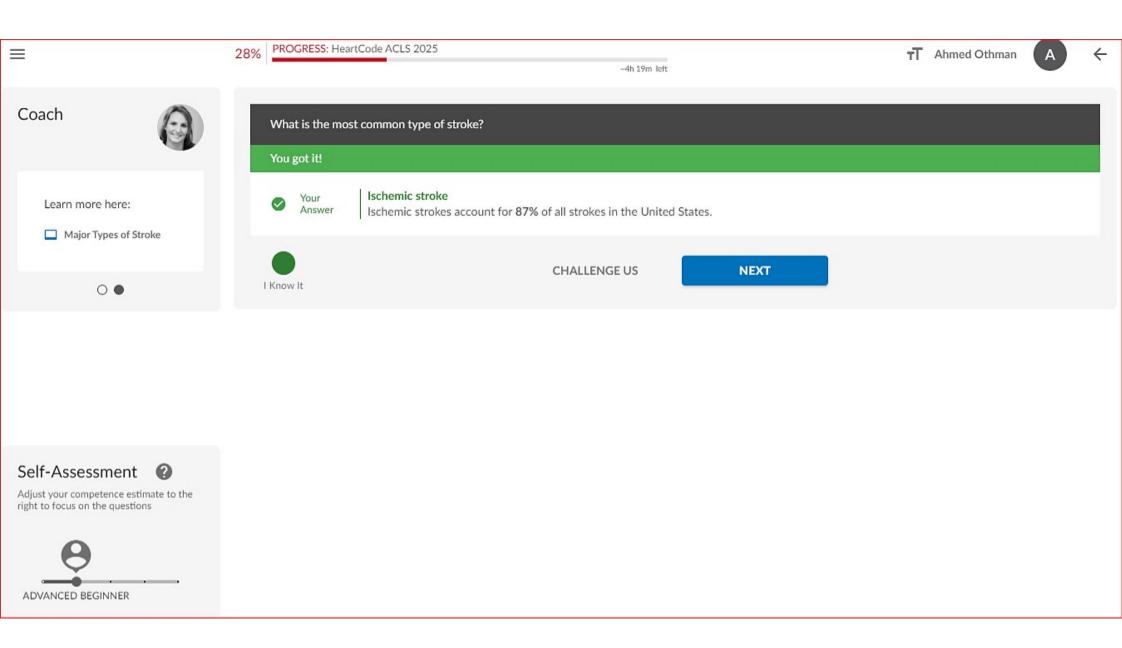
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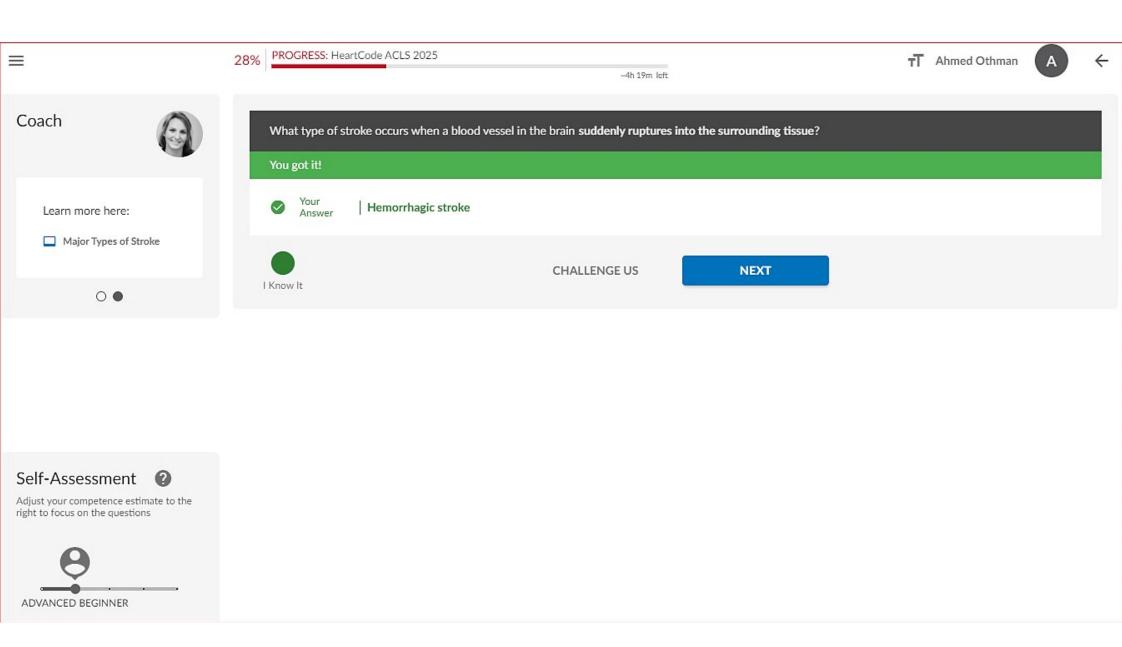
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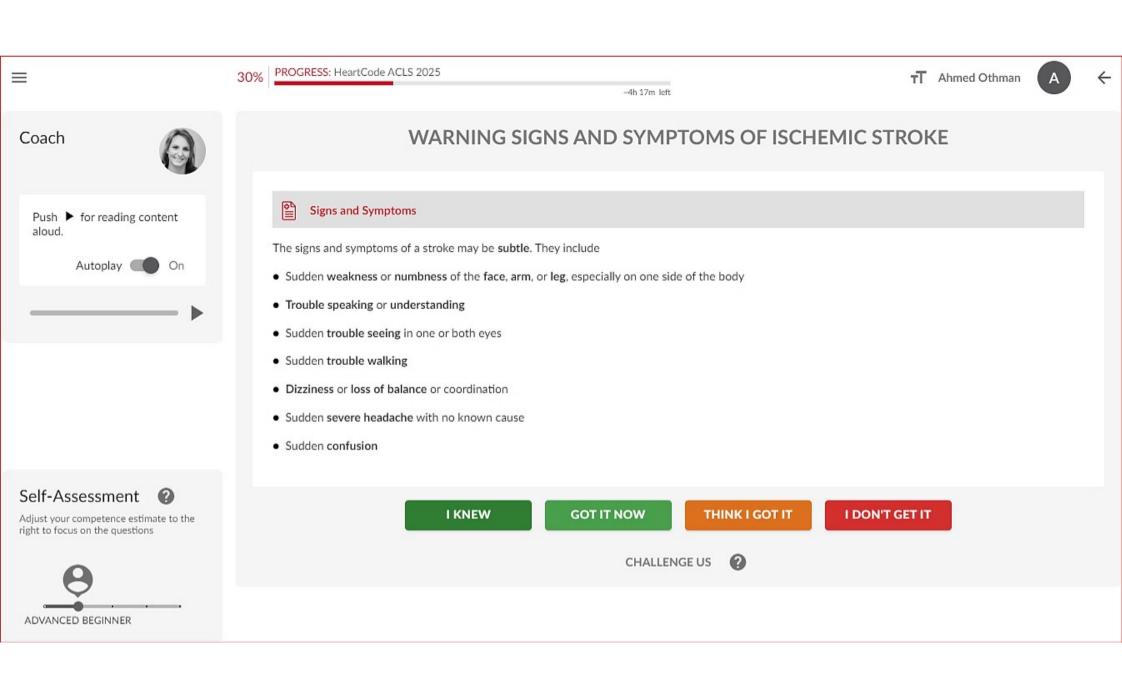
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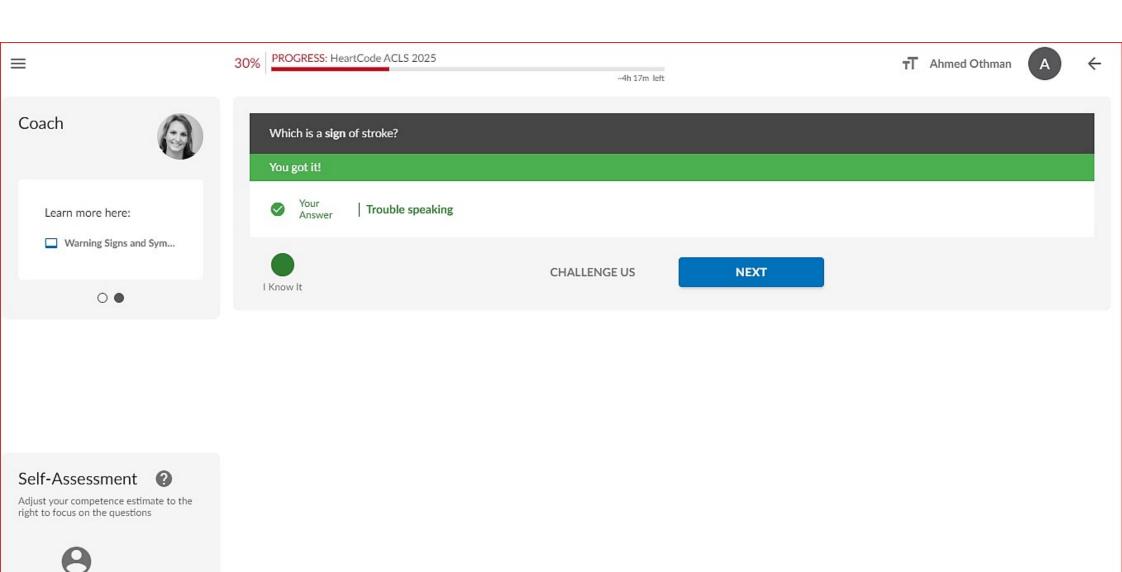
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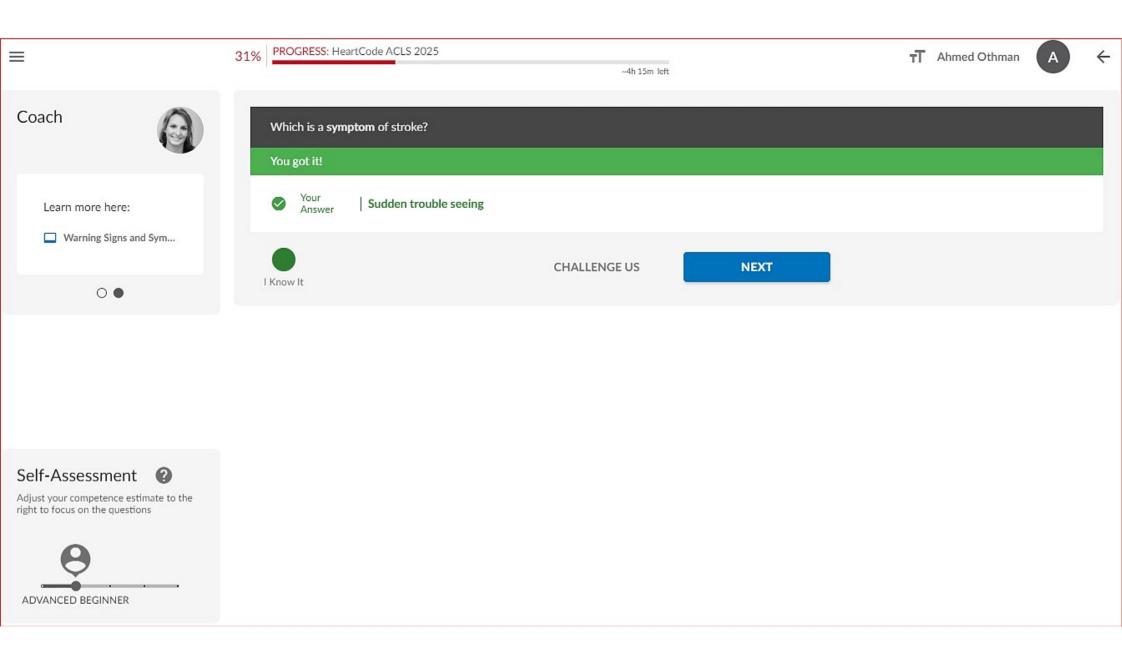


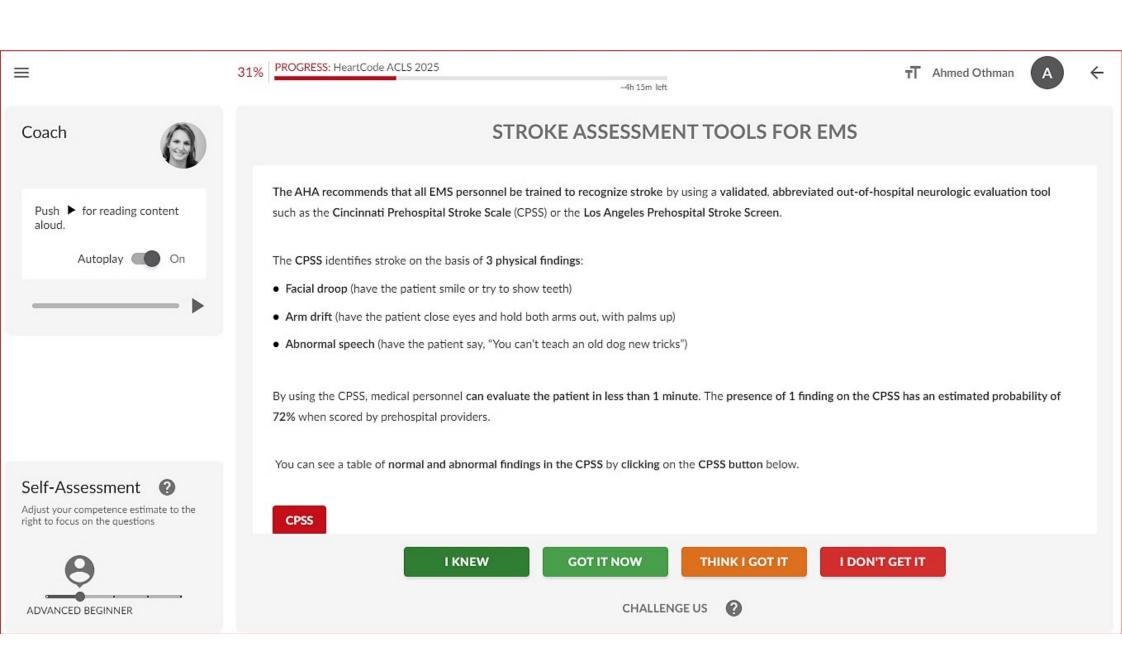






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Findings
Normal—both sides of the face move equally
Abnormal—one side of the face does not
move as well as the other side
Normal—both arms move the same or both
arms do not move at all (other findings, such
as pronator drift, may be helpful)
Abnormal—one arm does not move or one arm
drifts down compared with the other
Normal—patient uses correct words with no
slurring
Abnormal-patient slurs words, uses the
wrong words, or is unable to speak

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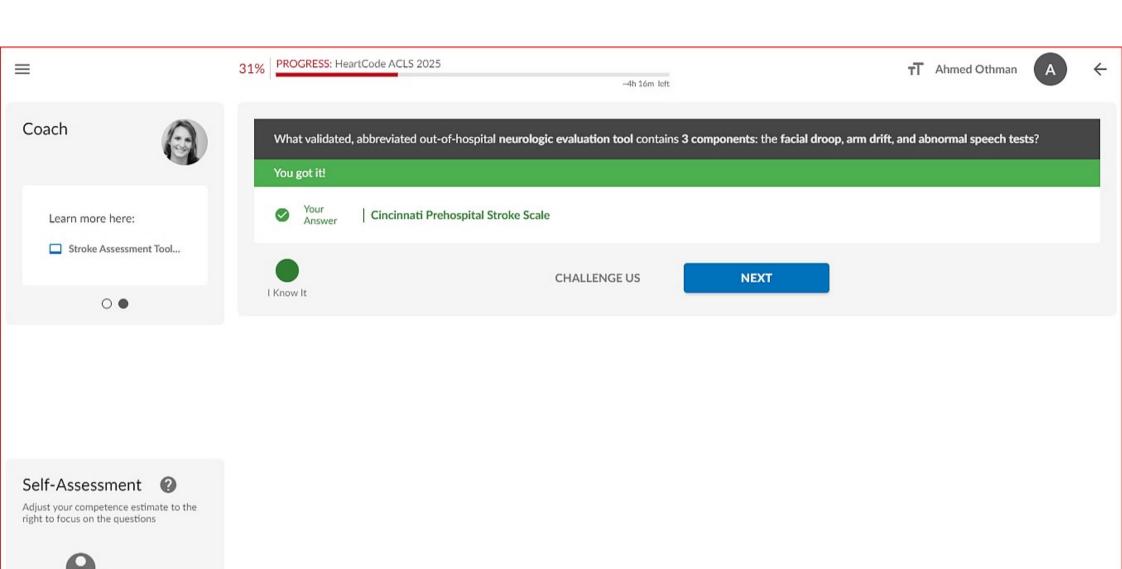
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Modified from Kothari RU, Pancioli A, Liu T, Brott T, Broderick J. Cincinnati Prehospital Stroke Scale: reproducibility and validity. Ann Emerg Med.1999;33(4):373-378. With permission from Elsevier.

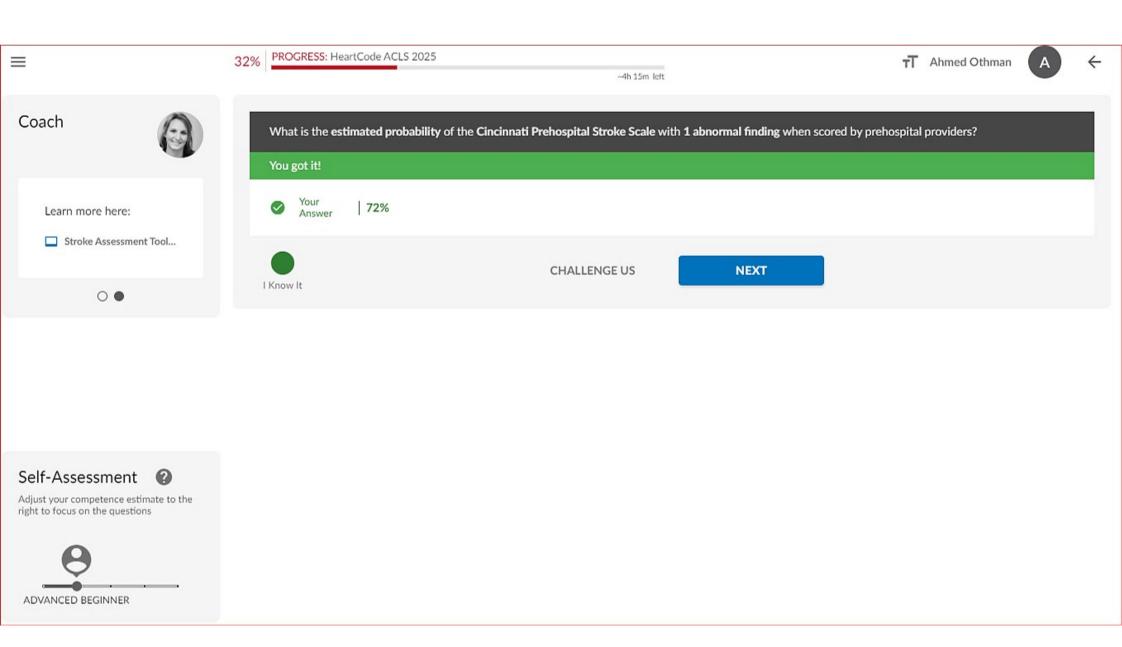
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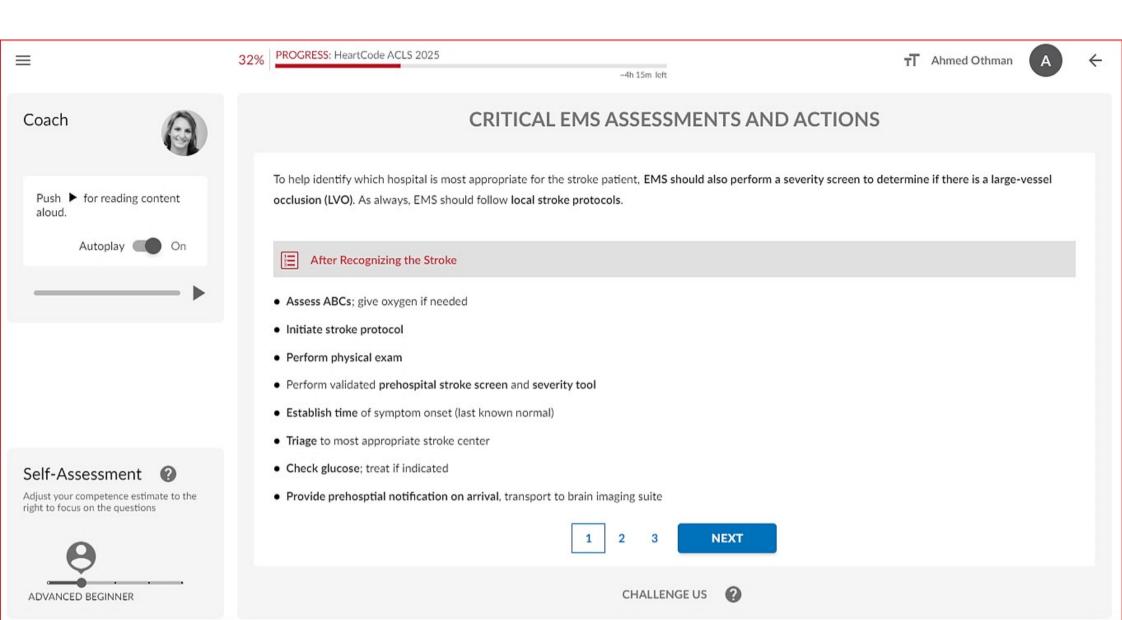
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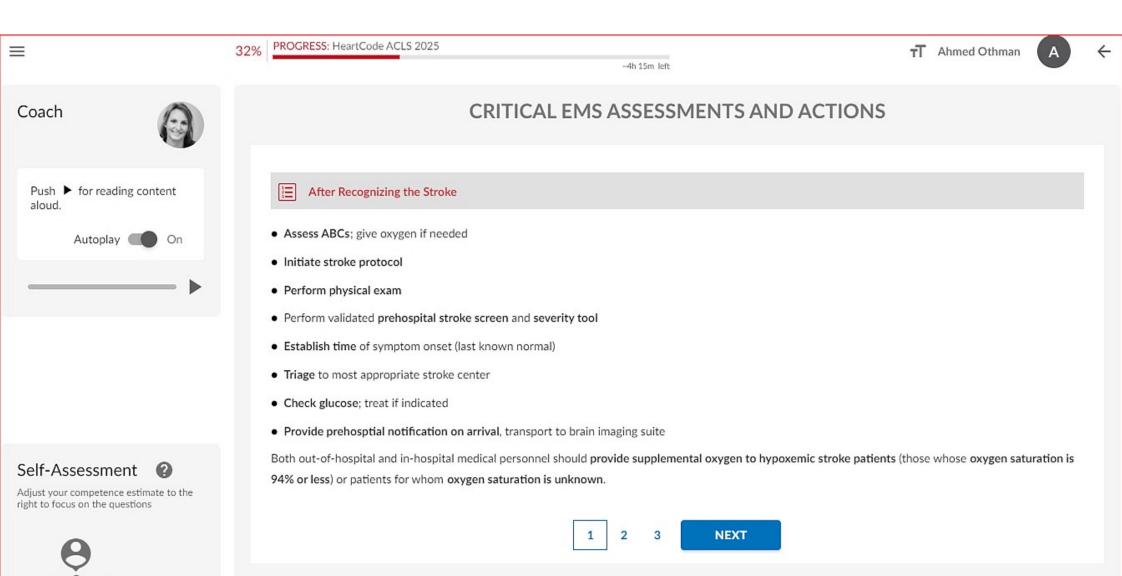
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